

## Volume 3

## Appendices

This is the third of four volumes of the Environmental  
Impact Statement on the  
Estuary Prawn Trawl Fishery



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# **APPENDIX A**



## **APPENDIX A1. LIST OF PROPONENTS**

(As at 14<sup>th</sup> February 2002)

| PROPONENTS                          | ADDRESS                 |                 |      |
|-------------------------------------|-------------------------|-----------------|------|
| AFFLECK, Colin Stuart               | C/O POST OFFICE         | PALMERS ISLAND  | 2460 |
| AIELLO, Carmelo John                | 98 COX'S ROAD           | NORTH RYDE      | 2113 |
| AIELLO, Estate of Andrew            | 14 CARRAMAR AVENUE      | EAST RYDE       | 2113 |
| ALECKSON, Barry John                | P O BOX 87              | LAWRENCE        | 2460 |
| ALECKSON, Robert Brian              | 13 CASHMORE STREET      | EVANS HEAD      | 2473 |
| ALEXANDER, Steven Wayne             | 14 IDA STREET           | MAYFIELD        | 2304 |
| ALOE, Charlie                       | 20 CAMPBELL AVENUE      | LEICHHARDT      | 2040 |
| ANDERSON, Peter David               | 38 STANLEY STREET       | MACLEAN         | 2463 |
| ANDERSON, Robert Joseph             | 115 BARRENJOEY ROAD     | ETTALONG BEACH  | 2257 |
| ANDERSON, Shane Alan                | 1/22 MELALEUCA DR       | YAMBA           | 2464 |
| APPS, Paul Alfred                   | 29 CYPRESS STREET       | MACLEAN         | 2463 |
| APPS, Trevor Edward                 | 46 MCLACHLAN STREET     | MACLEAN         | 2463 |
| ARBLASTER, John William             | C/- 3 BADARENE PLACE    | EAST LINDFIELD  | 2070 |
| AUSTON, Ross                        | 398 NORTH BANK ROAD     | PALMERS ISLAND  | 2463 |
| BACH, Cong Nhan                     | 49 HECTOR STREET        | SEFTON          | 2162 |
| BAGNATO, Giuseppe                   | 79 FLOOD STREET         | LEICHHARDT      | 2040 |
| BAILEY, Lawrence Charles            | P.O. BOX 236            | PYRMONT         | 2009 |
| BAKER, William Donald               | 45 CLARENCE STREET      | MACLEAN         | 2463 |
| BALL, Max Edward                    | 548 ROBERTS CREEK ROAD  | VIA BRUSHGROVE  | 2460 |
| BARTLETT, Jeffrey Alan              | 25 MICALO STREET        | ILUKA           | 2466 |
| BLACKLIDGE, Carl Gordon             | 28 STELLA RD            | UMINA BEACH     | 2257 |
| BLANCH, Phillip                     | 2396 FULLERTON COVE RD  | FULLERTON COVE  | 2318 |
| BOYD, Michael & McLEOD, Robert      | PO BOX 1141             | LEICHHARDT      | 2040 |
| BROOME, David                       | 185 GLENWORTH VALLEY RD | MOUNT WHITE     | 2250 |
| BROWN, John William                 | 114 HUTTON ROAD         | NORTH ENTRANCE  | 2261 |
| BUIE, James Norman                  | PO BOX 224              | BROOKLYN        | 2083 |
| BURNES, R.J. & A.C.                 | PO BOX 579              | MOOLOOLABA QLD  | 4557 |
| BURNES, Warren Edward               | 35 HOGAN STREET         | HARRINGTON      | 2427 |
| CAMPBELL, Brian Patrick             | 112 JUBILEE STREET      | TOWNSEND        | 2463 |
| CAMPBELL, Graham & Warren           | 2 KOONORA AVENUE        | BLACKWALL       | 2256 |
| CARRIGAN, Mark Thomas               | 4 BERGHOFER DRIVE       | MT VICTORIA     | 2786 |
| CHILD, Alfred George                | P.O. BOX 34             | MACLEAN         | 2463 |
| CLARKE, Dennis Boyd                 | 290 RIVER ROAD          | LOWER PORTLAND  | 2756 |
| CLEAVER, Walter Henry & John Robert | 569 NORTH BANK ROAD     | PALMERS CHANNEL | 2463 |
| CLENTON, Tony                       | 19 JENKINS ST           | DAVISTOWN       | 2251 |
| COLLIS, Gary John                   | 7 MICALO STREET         | ILUKA           | 2466 |
| COMPAIN, Ronald Camille             | P.O. BOX 138            | YAMBA           | 2464 |
| COROCHER, Shane Lenard Allan        | 90 WHARF STREET         | MACLEAN         | 2463 |
| CRANNY, Jeffrey Michael             | 5 PARK STREET           | ILARWILL        | 2463 |
| CRISAFI, Andrew Joseph & Perry Sam  | 34 MASCOT DRIVE         | EASTLAKES       | 2018 |
| CROAD, William Phillip              | 31 WOOLI STREET         | YAMBA           | 2464 |
| CROFTON, Kevin                      | 2967 PACIFIC HIGHWAY    | TYNDALE         | 2460 |
| CROFTON, Richard                    | 2967 PACIFIC HIGHWAY    | TYNDALE         | 2460 |
| CROMIE, John                        | 69 WHARF STREET         | TUNCURRY        | 2428 |
| CRUMPTON, Keith William             | PO BOX 16               | BEROWRA WATERS  | 2082 |
| DALEY, Gregory Keith                | 88 THE SCENIC ROAD      | KILLCARE        | 2257 |
| DANG, Dung Van                      | 9 DELLAR AVE            | CABRAMATTA      | 2166 |
| DAO, Van Truong                     | 20 MOONSHINE AVE        | CABRAMATTA WEST | 2166 |
| DAVIDSON, Claude William            | 108 BROOKLYN ROAD       | BROOKLYN        | 2083 |



| PROPOSERS                                 | ADDRESS                  |                       |      |
|-------------------------------------------|--------------------------|-----------------------|------|
| DAVIDSON, Jason & Matthew                 | LOT 10 WISEMANS FERRY RD | SPENCER               | 2775 |
| DAVIDSON, Jason Adam                      | LOT 10 WISEMANS FERRY RD | SPENCER               | 2775 |
| DAVIDSON, Sydney Thomas                   | LOT 10 WISEMANS FERRY RD | SPENCER               | 2775 |
| DAVIS, Christopher & Anne                 | 'WINDRIFT', RIVER ROAD   | LOWER PORTLAND        | 2756 |
| DAVIS, Garry Neville                      | 18 CENTRAL AVENUE        | MACLEAN               | 2463 |
| DAWSON, Glenn Boyd                        | 36 CLARENCE STREET       | LLARWILL, VIA MACLEAN | 2463 |
| DEPASQUALE, Dominic                       | 29 DUDLEY STREET         | HABERFIELD            | 2045 |
| DEPASQUALE, Frank                         | 141 HAMPDEN ROAD         | FIVE DOCK             | 2046 |
| DIMENTO, Antonio                          | 51 PERRY STREET          | LEICHHARDT            | 2040 |
| DIMENTO, Biagio                           | 15 BAKER STREET          | KENSINGTON            | 2033 |
| DIMENTO, Filippo                          | 23 PENGUIN PARADE        | HINCHINBROOK          | 2168 |
| DIMENTO, Vincent John                     | 83 BRAYS ROAD            | CONCORD               | 2137 |
| DOBBIN, Bruce                             | 38 JUBILEE STREET        | MACLEAN               | 2463 |
| DORRELL, Bruce Arthur                     | 43 WOODBURN STREET       | EVANS HEAD            | 2473 |
| DREW, Peter Lawrence                      | 14 HAMMOND STREET        | ILUKA                 | 2466 |
| DUFF, Graham William                      | No 3 FORESTWAY           | WOOMBAH               | 2469 |
| DWARTE, Barry James                       | 34 CENTRAL AVENUE        | MACLEAN               | 2463 |
| DWYER, Harold Sydney                      | PO BOX 94                | MACLEAN               | 2463 |
| EFEL HOLDINGS PTY LTD                     | 1 GLAD GUNSON DRIVE      | ELEEBANA              | 2282 |
| ELLEM, Gary Thomas Gordon                 | 3 THE PENINSULA          | YAMBA                 | 2464 |
| ESSEX, Matthew Charles                    | 36 CHURCH STREET         | MACLEAN               | 2463 |
| EVANS, Ashley                             | 20 BENT STREET           | CONCORD               | 2137 |
| EVERSON, Keith                            | 9 AGER STREET            | YAMBA                 | 2464 |
| EVERSON, Raymond John<br>(C/- B.A. ELLEM) | 19 UNION STREET          | MACLEAN               | 2463 |
| EVERSON, Stephen John                     | 591 NORTHBANK RD         | PALMERS ISLAND        | 2463 |
| FERNIE, Steven                            | 36 DOWNES CRESENT        | CURRANS HILL          | 2567 |
| FINCH (SNR), Bryon John                   | 79 EGGLETON STREET       | BLACKTOWN             | 2148 |
| FINN, Andrew                              | PO BOX 494               | MACLEAN               | 2463 |
| FORD, Alan Edwin                          | 6 MORVEN STREET          | MACLEAN               | 2463 |
| FORSTER, Wayne                            | P.O. BOX 80              | WOODBURN              | 2472 |
| GIBBONS, George John                      | 166 TOMAGO ROAD          | TOMAGO                | 2322 |
| GILLET, Craig William                     | 37 QUEEN STREET          | GRAFTON               | 2460 |
| GIOIA, Felice                             | 26 FRAZER STREET         | LEICHHARDT            | 2040 |
| GIUFFRE, Emanuel                          | 54 CURTIN STREET         | ABBOTSFORD            | 2046 |
| GLEDSON, Anthony                          | 5 CLYDE STREET           | STOCKTON              | 2295 |
| GOLDING, Donald                           | 7 TELOPEA AVENUE         | YAMBA                 | 2464 |
| GOODWORTH, Glenn William                  | 11 MacMASTERS PARADE     | MacMASTERS BEACH      | 2251 |
| GORRIE, Mark D                            | PO BOX 122               | WOOLGOOLGA            | 2456 |
| GRAHAM, Robert William & Elva Ruth        | 59 HAVELOCK STREET       | LAWRENCE              | 2460 |
| GRIVINS, Ivan Karl                        | 675 SOUTHBANK ROAD       | PALMERS CHANNEL       | 2463 |
| GUEST, Michael Gregory                    | 16 JAMES ROAD            | BROOKLYN              | 2083 |
| HALVORSON, Micheal Grant                  | 78 YAMBA STREET          | YAMBA                 | 2464 |
| HAMILTON, Robert A. & Suzane M.           | 39 PRESIDENT WILSON WALK | TANILBA BAY           | 2319 |
| HAREIDE, Gordon                           | 19 HIAWATHA ROAD         | MINNIE WATER          | 2460 |
|                                           |                          | via GRAFTON           |      |
| HAY, Micheal Wayne                        | 18 MONMOUTH STREET       | STOCKTON              | 2295 |
| HAYWARD, Andrew Ian                       | 160 YAMBA ROAD           | YAMBA                 | 2464 |
| HEWITT, John Arthur                       | 33 MAITLAND RD           | HEXHAM                | 2322 |
| HEWITT, John Leslie                       | 33 MAITLAND ROAD         | HEXHAM                | 2322 |
| HICKS, Dennis Charles                     | 13 NORFOLK STREET        | BERKELEY              | 2506 |
| HILLYARD, Graeme John                     | 330 BLACKWALL ROAD       | WOY WOI               | 2256 |
| HOLIPLAN PTY LTD                          | PO BOX 418               | GLENORIE              | 2157 |

| PROPOSERS                         | ADDRESS                  |                    |      |
|-----------------------------------|--------------------------|--------------------|------|
| HOLLIS, Mathew Dean               | 2 BUXTON LANE            | ADAMSTOWN          | 2289 |
| HORAN, Paul                       | 3940 LAWRENCE ROAD       | WOODFORD LEIGH     | 2463 |
| HORAN, Terrance Joseph            | PO BOX 112               | NANA GLEN          | 2450 |
| HORTON, Mark William              | 544 SOUTH BANK ROAD      | PALMERS CHANNEL    | 2463 |
| HOWARD, Gary                      | 771 RIVER RD             | LOWER PORTLAND     | 2756 |
| HOWARD, Graham George & Mary      | LOT 3 SINGLETON ROAD     | LAUGHTONDALE       | 2775 |
|                                   |                          | via WISEMANS FERRY |      |
| HUTCHEN, Charles Roupert          | 59 WATT STREET           | RAYMOND TERRACE    | 2324 |
| HUXLEY, Ray Patrick & Pamela Mary | 80 CENTRAL BUCCA ROAD    | CENTRAL BUCCA      | 2450 |
| HYDE, Dennis Maxwell              | 18 BAKER STREET          | MAYFIELD           | 2304 |
| HYDE, Gary Thomas                 | 7 LANTRY PLACE           | ANNA BAY           | 2316 |
| HYDE, Geoffrey Ronald             | 1 VARDON ROAD            | FERN BAY           | 2295 |
| HYDE, Robert John                 | 15 FULLERTON ROAD        | FERN BAY           | 2295 |
| IANNI, Charlie                    | 22 INDIANA AVE           | BELFIELD           | 2191 |
| IANNI, Salvatore & Charlie        | 1/25-29 SEVENTH AVENUE   | CAMPSIE            | 2194 |
| IANNI, Tony                       | 60 QUEEN ST              | CROYDON            | 2132 |
| ILACQUA, Francesco                | 8 POOLMAN STREET         | ABBOTSFORD         | 2046 |
| INMON, Brett Anthony              | 455 BROOMS HEAD ROAD     | GULMARRAD          | 2463 |
| IRELAND, David John               | 17 ST ALBANS STREET      | WISEMANS FERRY     | 2775 |
| IRELAND, Troy William             | 79 ST ALBANS ROAD        | WISEMANS FERRY     | 2775 |
| JAMES, Ian Edward                 | 85 SHOWGROUND ROAD       | NARARA             | 2250 |
| JEKSTADT, Daniel                  | LOT 22 CHASELING ROAD    | LEETSVALE via      | 2775 |
|                                   |                          | WISEMANS FERRY     |      |
| JOHNSON, Allan John               | 28 CENTRAL AVENUE        | MACLEAN            | 2463 |
| JOHNSON, Barry Robert             | 368 SOUTH ARM ROAD       | VIA BRUSHGROVE     | 2460 |
| JOHNSON, Desmond Charles          | 13 JAMIESON STREET       | MACLEAN            | 2463 |
| JOHNSON, Donald Mark              | 43 HARWOOD ST            | MACLEAN            | 2463 |
| JOHNSON, Gary Charles             | PUMPKIN CREEK            | VIA BRUSHGROVE     | 2775 |
| JOHNSON, Geoffrey Brian           | 640 NORTH BANK ROAD      | PALMERS CHANNEL    | 2463 |
| JOHNSON, Kevin Michael            | 27 WHARF STREET          | MACLEAN            | 2463 |
| JOHNSON, Mark Andrew              | 171 GOLFLINKS ROAD       | MACLEAN            | 2463 |
| JOHNSON, Robert Barry             | 640 NORTH BANK ROAD      | PALMERS ISLAND     | 2463 |
| JOHNSON, Ross Desmond             | 13 JAMIESON STREET       | MACLEAN            | 2463 |
| JOHNSON, Scott Laurence           | 8 SCULLIN STREET         | MACLEAN            | 2463 |
| JOHNSON, Tony Allan               | 23 MCLACHLAN STREET      | MACLEAN            | 2463 |
| JONES, Alfred William             | 4 ROSS STREET            | SWANSEA            | 2281 |
| KAKES, Steve                      | 1205/34 WENTWORTH STREET | GLEBE              | 2037 |
| KNOX, Stuart Gregory              | 2 BEAMISH ROAD           | NORTHMEAD          | 2152 |
| KRATZ, Cecil Owen                 | 389 GOODWOOD ISLAND ROAD | GOODWOOD ISLAND    | 2460 |
| KURZ, John Desmond                | 78 CHARLES STREET        | ILUKA              | 2466 |
| LALOR, Arthur Peter &             | 127 GREGORY STREET       | SOUTH WEST ROCKS   | 2431 |
| MUNDAY, Stephen Jack              |                          |                    |      |
| LAM, Van Hao                      | 2 FOXLOW STREET          | CANLEY HEIGHTS     | 2166 |
| LAUGHTON, D.J. & S.C.             | LAUGHTONDALE             | VIA WISEMANS FERRY | 2775 |
| LAUGHTON, Rodney Paul             | LOT 1 SINGLETON ROAD     | WISEMANS FERRY     | 2775 |
| LAW, Donald John                  | 31 McLACHLAN STREET      | MACLEAN            | 2463 |
| LAW, Neville John                 | 33 RIVER STREET          | MACLEAN            | 2463 |
| LE, Hoang Von                     | 30/90 Longfield Street   | CABRAMATTA         | 2166 |
| LEESON, Max Raymond               | 25 BALANDA CRESCENT      | ILUKA              | 2466 |
| LOSURDO, Domenico                 | 17 FRAZER STREET         | LEICHHARDT         | 2040 |
| LOSURDO, Estate of Giuseppe       | 30 THOMPSON STREET       | DRUMMOYNE          | 2047 |
| LOSURDO, Salvatore                | 23 FRAZER STREET         | LEICHHARDT         | 2040 |
| LOSURDO, Santo                    | 3 DOBROYD PARADE         | HABERFIELD         | 2045 |

| PROPOSERS                        | ADDRESS                 |                 |      |
|----------------------------------|-------------------------|-----------------|------|
| LUKE, John Edward & Troy Vincent | 62 FORFAR STREET        | STOCKTON        | 2295 |
| MACCHIA, Robert                  | 76 IRIS STREET          | BEACON HILL     | 2100 |
| MARSH, Barry Stephen             | 8 OLD PACIFIC HIGHWAY   | WOOMBAH         | 2469 |
| MASON, Tony                      | 49 MAITLAND ROAD        | HEXHAM          | 2322 |
| MCINTOSH, Kevin Bruce            | 83 UNION STREET         | NEWCASTLE       | 2300 |
| McKENNA, Thomas Davis            | C/O 237 GERTRUDE STREET | NORTH GOSFORD   | 2250 |
| MCLEAY, Brad & Ted               | 53 PARKES STREET        | NELSON BAY      | 2315 |
| McLEAY, Maxwell Frances          | PO BOX 824              | RAYMOND TERRACE | 2324 |
| MCLELLAN, James                  | 104 SPENCER STREET      | ILUKA           | 2466 |
| McPHERSON, Graham John           | 20 COOK STREET          | YAMBA           | 2464 |
| MEYER, William Jacobus           | 77 MELALEUCA DRIVE      | YAMBA           | 2464 |
| MILLER, Colin Brian              | 5 PINE AVENUE           | DAVISTOWN       | 2251 |
| MISLOV, Joso                     | 3/85 BENJAMIN LEE DRIVE | RAYMOND TERRACE | 2324 |
| MOLONEY, Christopher Gerard      | 13 MCPHEE STREET        | MACLEAN         | 2463 |
| MORAN, Deane Scott               | 79 JUBILEE ST           | TOWNSEND        | 2463 |
| MORRISON, Robert Charles         | 20 JACARANDA ST         | PATONGA         | 2256 |
| MOWBRAY, Donald E. & Lynne J.    | PO BOX 367              | MACLEAN         | 2463 |
| MOXHAM, Carl Phillip             | P.O. BOX 75             | BROOKLYN        | 2083 |
| MUSUMECI, Carlo                  | 117 ALMA ROAD           | MAROUBRA        | 2035 |
| MYER, Gregory Nicholas           | 12 BLYTHE STREET        | KILLCARE        | 2257 |
| NAPIER, Ron & Ken                | 3 CROSS STREET          | SEAHAM          | 2324 |
| NEWTON, Daryl James              | 19 LORIKEET ROAD        | GULMARRAD       | 2463 |
| NGUYEN, Hao Ngoc                 | 2 McPHERSON AVE         | PUNCHBOWL       | 2196 |
| NGUYEN, Huu Doan                 | 15 ABEL STREET          | MAYFIELD        | 2304 |
| NGUYEN, Thanh Hung               | 68 CREBERT STREET       | MAYFIELD        | 2304 |
| NGUYEN, The Trung                | 181 MEADOWS ROAD        | MOUNT PRITCHARD | 2170 |
| NGUYEN, Van Dau                  | 4/8 THESIGER ROAD       | BONNYRIGG       | 2177 |
| NGUYEN, Van Dong                 | 29 KINGSTON ROAD        | CAMPERDOWN      | 2050 |
| NGUYEN, Van Luong                | 10 IAN AVENUE           | CANLEY VALE     | 2166 |
| NGUYEN, Van Ly                   | P O BOX 186             | REGENTS PARK    | 2143 |
| NGUYEN, Van Nanh                 | 20 ORLANDO PLACE        | EDENSOR PARK    | 2176 |
| NGUYEN, Van Nho                  | 101 WATER STREET        | CABRAMATTA      | 2166 |
| NGUYEN, Van Thanh                | 15 THESIGER ROAD        | BONNYRIGG       | 2177 |
| NGUYEN, Van Thanh                | 36 MERLE STREET         | CHESTER HILL    | 2162 |
| NGUYEN, Van Tong                 | 12 JELLCOE STREET       | CONDELL PARK    | 2200 |
| NORINGTON, Rolf William          | P O BOX 159             | BROOKLYN        | 2083 |
| OCEANIC SEAFOODS PTY LTD         | PO BOX 233              | BROOKLYN        | 2083 |
| O'CONNOR, Patrick John           | 35 RODERICK STREET      | MACLEAN         | 2463 |
| OESTMANN, Mark Dean              | P O BOX 110             | ILUKA           | 2466 |
| OLSSON, Russell Walter           | 40 ROSLYN ST            | ASHBURY         | 2193 |
| OPALNIUK, Dean                   | 157 GOLFLINKS ROAD      | MACLEAN         | 2463 |
| OPALNIUK, Yaroslav               | 157 GOLFLINKS ROAD      | MACLEAN         | 2463 |
| ORR, Darryl Leslie               | LOT 3 CLARENCE STREET   | BRUSHGROVE      | 2460 |
| OUTRAM, Jeffrey Arthur Bruce     | 6 OAK STREET            | INNISFAIL, QLD  | 4860 |
| PALUMBO, Giuseppe                | 163 FRANCIS STREET      | LEICHHARDT      | 2040 |
| PANTO, Andrew                    | 20 BELLEVUE STREET      | ARNCLIFFE       | 2205 |
| PANTO, Tony                      | 49 LYNWEN CRESCENT      | ROCKDALE        | 2216 |
| PARROTT, Adrian James            | 18 SOPHIA JANE AVENUE   | WOODBERRY       | 2322 |
| PATEMAN, Graham Noel             | 80 McLACHLAN STREET     | MACLEAN         | 2463 |
| PATEMAN, Ricky Mark              | 21 DIAMOND STREET       | TOWNSEND        | 2463 |
| PATEMAN, Stephen James           | 28 TALOUMBI STREET      | MACLEAN         | 2463 |
| PERRY, John Alston               | 23 FLORIDA AVENUE       | WOY WOI         | 2256 |
| PETERSON, Mark Neil              | 35 PATONGA STREET       | PATONGA         | 2256 |

| PROPOSERS                              | ADDRESS                  |                     |      |
|----------------------------------------|--------------------------|---------------------|------|
| PHAM, Thanh Thuy                       | 6 McCROSSIN AVENUE       | BIRRONG             | 2143 |
| PHAM, Van Dung                         | 26 CHERRYBROOK ROAD      | LANSVALE            | 2166 |
| PHAM, Van Mai                          | P.O. BOX 927             | MARRICKVILLE        | 2204 |
| PHAM, Van Thom                         | 11/69 WARREN ROAD        | MARRICKVILLE        | 2204 |
| PHAN, Van Chien                        | 3 LIVERPOOL STREET       | CABRAMATTA          | 2166 |
| PHAN, Van Em                           | 21 CURRINGA ROAD         | VILLAWOOD           | 2163 |
| PICKFORD, Allan John                   | 441 CORALVILLE ROAD      | MOORLAND            | 2443 |
| PICTON, Peter John                     | 52 McLACHLAN STREET      | MACLEAN             | 2463 |
| PLATER, Joseph Roland                  | 143 PHILLIP DRIVE        | SOUTH WEST ROCKS    | 2431 |
| PRINDABLE, Ronald James                | 54 RIVERVIEW STREET      | ILUKA               | 2466 |
| QUACH, Con                             | 26 CHERRYBROOK ROAD      | LANSVALE            | 2166 |
| RAMAGE, Douglas Graeme                 | PO BOX 6254              | KINCUMBER           | 2251 |
| RAWLINGS, Robert Bruce                 | 1 PALM LANE              | HARWOOD ISLAND      | 2465 |
| REEVES, Peter Rodney                   | 69 STEVENSON AVENUE      | MAYFIELD WEST       | 2304 |
| RESTUCCIA, Giuseppi                    | 61 CHURCH STREET         | LEICHHARDT          | 2040 |
| ROBERTSON, Allan Warren                | 277 RIVER ST             | KEMPSEY             | 2440 |
| ROBINSON, Henry & Peter                | 3 ELAINE AVENUE          | AVALON              | 2107 |
| ROSE, Allan Paul                       | LOT 11, SINGLETON ROAD   | LAUGHTONDALE        | 2775 |
| ROSE, Barry Robert                     | 87 KEDA CIRCUIT          | NORTH RICHMOND      | 2754 |
| ROSE, Geoffrey Arthur                  | 72 TIZZANA ROAD          | EBENEZER            | 2756 |
| RUTHERFORD, Stephen John               | 363 NORTH BANK ROAD      | PALMERS ISLAND      | 2463 |
| SARCASMO, Andrea                       | 72E TABRETT STREET       | ROCKDALE            | 2216 |
| SHAKESPEARE, Aaron                     | 23 ALDWICK CLOSE         | TARRO               | 2322 |
| SHILLING, Norman Gordon                | P.O. BOX 6387            | COFFS HARBOUR PLAZA | 2450 |
| SINGLETON, Douglas Hedley              | 19 KARoola STREET        | BROOKLYN            | 2083 |
| SMIDT, Ronald Leslie                   | 98 JUBILEE STREET        | MACLEAN             | 2463 |
| SMITH, David John & Kim Maree          | 67 OSPREY DRIVE          | YAMBA               | 2464 |
| SMITH, Jeremy Mathew Scott             | LOT 327 HAWKESBURY RIVER | PATONGA             | 2256 |
| SMITH, Paul Raymond                    | 918 RIVER RD             | LOWER PORTLAND      | 2756 |
| SMITH, Sydney Donald                   | 16 WOY WOY ROAD          | KARIONG             | 2250 |
| SPAIN, Neil David & BELL, Matthew      | 9/29 GANNONS AVENUE      | DOLLS POINT         | 2219 |
| SPROULE, Geoffrey Warren               | 50 GALoola DRIVE         | NELSON BAY          | 2315 |
| SQUADRITO, Biagio                      | 28 LAMROCK AVENUE        | FIVE DOCK           | 2046 |
| STEPHENSON, Kenneth Mervyn             | 421 SOUTH ARM ROAD       | BRUSHGROVE          | 2460 |
| STRATTON, Alan Raymond                 | 25 URALBA STREET         | WOODBURN            | 2472 |
| SULLIVAN, P. (CLARENCE VALLEY PRODUCE) | PO BOX 447               | YAMBA               | 2464 |
| SWAN, Robin Neil                       | 14 THOMPSON STREET       | ILUKA               | 2466 |
| TANSEY, David William                  | 16 DOROTHY AVENUE        | WOY WOY             | 2256 |
| TESAR, Karl                            | 699 NORTH BANK ROAD      | PALMERS ISLAND      | 2463 |
| THANH, Hoa Mai & NGUYEN, Thi Chinh     | 53 KALORA AVE            | FAIRFIELD WEST      | 2165 |
| THOMPSON, Glenn Charles                | 794 WISEMANS FERRY ROAD  | SPENCER             | 2775 |
| THOMPSON, Rodney James                 | 129 SALAMANDER WAY       | SALAMANDER          | 2317 |
| THORNTON, Garry Andrew                 | P.O.BOX 49               | BROOKLYN            | 2083 |
| TO, Anh Tuan                           | 5 SUNNYSIDE STREET       | MAYFIELD            | 2304 |
| TRAN, Bay Van                          | 65 BECKENHAM STREET      | CANLEY VALE         | 2166 |
| TRAN, Duc Hieu                         | 191 TOWNVIEW ROAD        | MOUNT PRITCHARD     | 2170 |
| TRAN, Hai Tam                          | 81 O'BRIEN PARADE        | LIVERPOOL           | 2170 |
| TRAN, My Hoa                           | 49 DALTON AVENUE         | CONDELL PARK        | 2200 |
| TRAN, Van Hong                         | 72 GUNDAROO STREET       | VILLAWOOD           | 2163 |
| TRAN, Van Sang                         | 4/67 WARREN ROAD         | MARRICKVILLE        | 2204 |
| TRELOAR, David Humphrey                | 8 LINK STREET            | YAMBA               | 2464 |

| PROPONENTS                             | ADDRESS               |                    |      |
|----------------------------------------|-----------------------|--------------------|------|
| TRUONG, Van Hai                        | 27/4-11 EQUITY PLACE  | CANLEY VALE        | 2166 |
| VAN DER NEUT, Thomas Cornelius         | 177 OCEAN BEACH ROAD  | WOY WOY            | 2256 |
| VICKERY, Dale John                     | MANTONS ROAD          | LAWRENCE           | 2460 |
| VIRTU, Francesco                       | 14 STEWARD STREET     | LEICHHARDT         | 2040 |
| WALLACE, William Cooper                | 4 CAMERON ST          | MACLEAN            | 2463 |
| WANT, Ivan Leslie                      | 2/29 RANNOCH AVE      | MACLEAN            | 2463 |
| WARREN, Bradley                        | 9 PARK STREET         | MEREWETHER         | 2291 |
| WATKINS, Clarence John                 | LOWER HAWKESBURY      | VIA WISEMANS FERRY | 2775 |
| WATKINS, Mark John                     | LOT 50 SINGLETON ROAD | LAUGHTONDALE       | 2775 |
| WATTERSON, Dean Anthony                | 41 KAHIBAH ROAD       | UMINA              | 2257 |
| WEBBER, Bowen G. &<br>BUTLER, Garry J. | 4 RIVERVIEW AVENUE    | DANGAR ISLAND      | 2083 |
| WEBBER, Daniel Henry                   | 34 HALLS ROAD         | COFFS HARBOUR      | 2450 |
| WESTERN FISHERIES PTY LTD              | 21 TECOMA ROAD        | PALMWOODS          | 4555 |
| WHITE, Robert John                     | P.O. BOX 125          | MACLEAN            | 2463 |
| WIBLEN, Victor Leslie                  | 7 POST OFFICE LANE    | CHATSWORTH ISLAND  | 2469 |
| WILKS, Richard James                   | 46 CESSNOCK ROAD      | WESTON             | 2326 |
| WILKS, Steven James                    | 46 CESSNOCK ROAD      | WESTON             | 2326 |
| WILLIAMS, Graeme L. & Jennifer A.      | 292 JAMES CREEK RD    | via MACLEAN        | 2463 |
| WILLIAMS, John Lesleigh                | PO BOX 93             | YAMBA              | 2464 |
| WILSON, Graham John                    | P.O BOX 13            | LAWRENCE           | 2460 |
| WITCHARD, Guy Alexander                | 30 BAY STREET         | PATONGA BEACH      | 2256 |
| WITCHARD, Keith James                  | 38 JACARANDA AVENUE   | PATONGA            | 2256 |
| WOODHOUSE, David John                  | 21 HAVELOCK STREET    | LAWRENCE           | 2460 |
| WOODWARD, David James                  | RMB 2248, COX'S LANE  | FULLERTON COVE     | 2318 |
| ZACCARIA, Robert                       | 38 AMAROO CRES        | GEORGES HALL       | 2198 |
| ZAHRA, Andrew                          | 812 WINDSOR ROAD      | ROUSE HILL         | 2155 |
| ZOJO PTY LIMITED                       | 21 WATERVIEW CRESENT  | WOOMBAH            | 2469 |



## **A2. PLANNING NSE GUIDELINES**

### **APPENDIX A2. PLANNING NSW GUIDELINES (FORMERLY DUAP GUIDELINES)**



**Guidelines for the  
Environmental Impact Assessment  
of  
Draft Fishery Management Strategies  
for  
Commercial Designated Fishing Activities**

**August 2001**

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## **FOREWORD**

The Environment Impact Assessment process under the Environmental Planning and Assessment Act 1979 provides a framework for assessing the ecological sustainability of commercial fishery management strategies prepared for commercial fisheries under the Fishery Management Act 1994. The Environmental Impact Statement is an important tool as it informs proponents of likely impacts and allows for the consideration of alternative management and mitigation measures when formulating the fishery management strategy. It enables the community to review the proposed strategy, its objectives and management regimes and to provide for community input. It also informs decision makers of the likely sustainability of the proposed strategy and of the need for mitigation measures.

These guidelines outline the issues to be addressed in environmental impact statements for commercial fishery management strategies. They have been developed with input from Environment Australia, relevant State agencies, Commercial Fishery Management Advisory Committees, Fishery Advisory Councils, endorsement holders and representatives of the scientific and community organisations.

These guidelines have been issued by the Director-General under clause 230 (1)(a) of the Environmental Planning and Assessment Regulation 2000 and must be considered by NSW Fisheries or those proponents responsible for preparing an EIS to assess the likely significance of impacts of implementing a Commercial Fishery Management Strategy. The guidelines replace the general requirements for the contents of an EIS under Schedule 2 of the EP&A Regulation 2000.

The guidelines only apply to commercial fisheries including Category 1 Share Management Fisheries and Category 2 Share Management Fisheries. Other guidelines will be developed to apply to charter boat fisheries, recreational fisheries, fish stocking and shark meshing.

In addition to reference to this guideline when preparing an EIS for a fishery management strategy, NSW Fisheries or the proponent responsible for preparing the EIS must also consult the Director-General as to whether there are any additional requirements (to those in these guidelines) to be considered in the preparation of the EIS.

These guidelines have included relevant matters to meet the Commonwealth "Benchmarks and Terms of Reference for Environmental Assessment of Fisheries" and to satisfy the Commonwealth Government "Guidelines for the Ecologically Sustainable Management of Fisheries" for the purposes of Schedule 4 of the Commonwealth Wildlife Protection (Regulation of Exports and Imports) Act 1982. The guideline has also highlighted the importance of identifying if the fishery activity is likely to affect the matters of national environmental significance set out in the Environmental Protection and Biodiversity Conservation Act 1999 (EPBC Act). Matters of national environmental significance includes World heritage areas, declared Ramsar wetlands, listed threatened species and ecological communities, listed migratory species, nuclear actions and the environment of the Commonwealth marine area. If fisheries are likely to affect matters of national environmental significance (including listed marine species), the Commonwealth will need to be consulted to determine whether approval is required under the EPBC Act.

I commend these guidelines to all those involved in developing or assessing commercial fishery management strategies.

Sue Holliday  
**Director-General**

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## A. Commercial Fishery Management Strategies

### Overview

The Fisheries Management (FM) Act 1994 requires a management strategy to be developed for all major commercial fisheries. These strategies are to set out the management objectives and goals of each fishery, the management rules, performance indicators and monitoring regimes to determine if the strategy's objectives are being achieved. Information on the current operation and status of the fisheries, and the vision for future management of the fishery will be considered. The strategy will include all controls affecting the operation of the fishery and will focus on achieving sustainable performance objectives.

Fishery management strategies are to be prepared for the following designated fishing activities:

- Commercial fisheries
  - Category 1            Share Management Fisheries - abalone fishery and the lobster fishery
  - Category 2            Share Management Fisheries - ocean prawn trawl fishery, ocean fish trawl fishery, ocean hauling fishery, ocean trap and line fishery, the estuary general fishery and the estuary prawn trawl fishery.
- Charter boat fisheries
- Recreational fisheries
- Fish stocking
- Shark meshing, and
- Other fishing activities proclaimed by the Governor on the recommendation of the Minister for Fisheries to be designated fishing activities.

These provisions do not apply to aquaculture.

Prior to its finalisation, the draft strategy must undergo environmental assessment under the provisions of Part 5 of the Environmental Planning and Assessment (EP&A) Act 1979 to test its sustainability in terms of resource and environmental management. The environmental assessment is an examination of the environmental impacts of the fishing activities and considers biological, biophysical, economic and social issues. It must also consider the impact on the resource from other fisheries and non-fishing activities.

The environmental assessment will rely on best available information to predict impacts of the proposed activities on the environment. The assessment may highlight areas where further information should be gathered, where practices should be changed and where alternative management regimes may be required. The broader community as well as the endorsement holders, Management Advisory Committees (MACs), Advisory Councils and the Fisheries Resource Conservation and Assessment Council (FRCAC) will be given an opportunity to comment on the EIS and the draft management strategy.

Licences and authorisations issued in accordance with the strategy are exempted from having to undergo environmental assessment of the impacts of fishing under each individual licence. There is

a transitional period until 1 July 2003 exempting individual licences from the need for environmental assessment to provide NSW Fisheries time to prepare fisheries management strategies for commercial fisheries. After that time, environmental assessment will be required prior to issuing each individual license or authorisation which are not consistent with the strategy or in all fisheries where a strategy is not in place.

***Purpose of a commercial fishery management strategy***

A commercial fishery management strategy is a document outlining the management goals, objectives, controls and other measures for achieving the objectives, performance indicators and monitoring programs applying to a particular commercial designated fishing activity. The strategy must contain the “management tools” applying to the commercial fishery, as well as data collection protocols and triggers for the review of the strategy.

The strategy should be an informative document detailing the future vision for the management of the particular designated fishing activity – including:

- short, mid and long term vision for the fishery
- regulatory controls, management arrangements and other measures for achieving the vision including setting target effort or fishing capacity of each fishery and any restructuring program
- the framework for providing fishers and other stakeholders with greater certainty about the rules and administrative arrangements applying to the fishery.
- An information resource for the endorsement holders as well as the broader community on a particular fishery

The strategy is to be prepared in accordance with section 7E of the Fisheries Management Act and this guideline. The Minister must consult with the Fisheries Resource Conservation and Assessment Council on the preparation or revision of a fishery management strategy.

Under section 7E of the FM Act, the Fishery Management Strategy is to:

1. Describe the objectives of the Strategy
2. Describe the designated fishing activity
3. Outline any likely interaction of the designated fishing activities with other fishing activities
4. Outline the fishing regulatory controls or proposed fishing regulatory controls which apply to the designated fishing activity including:
  - (a) Provisions in the Fisheries Management Act or Regulations
  - (b) Any management plan or draft management plan
  - (c) Fishing closures under section 8 of the FM Act
  - (d) Fishing approvals
  - (e) Any determinations of the TAC Committee under Division 4 of Part 2 of the FM Act
  - (f) Policies approved by the Fisheries Minister
  - (g) Any relevant provisions in environmental planning instrument
5. Identify performance indicators to monitor whether the objectives of the strategy are being achieved
6. Describe how the designated fishery activity is to be monitored
7. Specify at what point a review of the strategy is required when a performance indicator is not

The fishery management plan should be described in the Fishery Management Strategy. It should outline the classes of shares and the “rights” of shareholders as set out in the FM Act. The first management plan in a Category 2 Share Management Fisheries cannot be approved until the Strategy as a whole has been assessed and a determination made under Part 5 of the Environmental Planning and Assessment (EP&A) Act 1997.

***Managing a dynamic complex system with uncertainty and limited information***

Those responsible for developing and implementing the strategy must deal cautiously with the risks and uncertainties associated with the exploitation of fishery resources. Estimating the level of catch that can be safely taken from a fish stock is not simple. Unlike many land-based natural resources, it is much more difficult to accurately assess how many fish there are in the estuarine and coastal waters. Moreover, a number of factors can influence the numbers of fish present, with fishing being only one.

The factors to consider in determining the size and resilience of fish stocks include:

- fecundity (the level of egg production), growth rates, rates of natural mortality and fishing mortality,
- oceanographic and climatic conditions (such as water temperature, current speed and direction, nutrient rich upwellings, rainfall, etc.), and
- habitat opportunities and constraints and the health of important habitats for the stock life cycle.

Such varying factors provide great challenges for the fishers who are trying to catch the fish, the scientists who are studying the fish, and the managers who are trying to achieve sustainable harvest levels.

Even if fishing did not take place, there can be natural variations in the abundance of some species from season to season and year to year. As a result there needs to be build into any management strategy, a monitoring program for fish stocks and triggers to adjust the level and nature of fishing activity when necessary. In addition, non-fishing activities such as disturbance of breeding areas from increasing urban development and poor water quality from poor land/catchment management including the unmanaged disturbance of acid sulfate soils, can put pressure on fisheries and their ecosystems which may reduce the ability of the natural environment to support the same level of aquatic life.

Fisheries research has traditionally focused on target species and their lifecycle with stock assessments based on the analysis of the relative abundance, the size and age of the catch, fish behaviour (eg migrations, aggregation for spawning) and reproductive cycles. However, with increasing emphasis on the conservation of biodiversity, research directions have been recently expanded to examine the effects of fishing on non-target species, ecosystem and habitat conservation issues based on bioregions.

Changing market demands, natural cycles in species abundance and availability and technological improvements mean that fishers are constantly changing the way they fish and perhaps even the species targeted. The result is a need for flexible management regimes and robust performance monitoring programs. The fisheries strategy must recognise and cater for the prospect that management rules may need to be changed from time to time in response to modify fishing activity or unpredictable conditions.

### ***Management tools***

Fisheries management involves the implementation of policies and rules that affect fisher behaviour. A range of management tools are available under the FM Act or Regulation including provisions limiting who has access to the fishery, where and when fishing can occur, input controls such as gear and boats or output controls such as the size, number and type of fish which may be taken (see Table 1). Other controls may be specified in management plans developed under the provisions of the FM Act or Regulation for share management fisheries and any associated determination made by a relevant Total Allowable Catch (TAC) Committee.

Management tools may include provisions relating to aquatic and other reserves under the FM Act or National Parks and Wildlife (NPW) Act, to marine parks under the Marine Parks Act 1997 or to an environmental planning instruments under the EP&A Act. Other legislation and policies provide environmental protection measures relevant to the management of the fisheries. These include Wildlife Protection (Regulation of Export and Imports) Act, Environment Protection and Biodiversity Conservation (EPBC) Act, NPW Act and FM Act. International conventions relating to wetland, migratory birds and whale protection also are relevant. See Appendix 1 for a list of the relevant legislation and responsible authorities.

**Table 1 Management Tools**

|                                                                               |                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Limiting who has access</b>                                                | <b>Limited access regimes</b> can be used to limit entry to participants in a particular fishery or part of a fishery. They usually include eligibility rules and rules relating to the transfer of entitlements.                                                                                                    |
|                                                                               | <b>Restructuring programs</b> can provide a concentrated or focused change in management procedures to achieve an accelerated change in expected outcomes <sup>1</sup> . These may include minimum entitlement holdings, buy back schemes and restructuring through transferability programs.                        |
| <b>Limiting where and when the fishing can occur</b>                          | <b>Fishing closures</b> which restrict commercial and/or recreational fishing for a specified period of time, any fishing or fishing for certain classes of fish in any waters or from specified waters                                                                                                              |
|                                                                               | <b>Recreational fishing areas</b> which are a form of fishing closure may give preferential fishing rights to recreational fishers and may partly or totally restrict commercial fishers                                                                                                                             |
|                                                                               | <b>Recognised fishing grounds</b> are areas used regularly or intermittently for net fishing by commercial fisheries and which have been mapped and approved by the Director and where commercial net fishers are given priority under clause 105 of the FM Regulation.                                              |
| <b>Input controls limiting the equipment used to take fish</b>                | <b>Gear restrictions</b> limit the size and type of gear (in possession or that can be used to take fish) such as size and number of nets/traps/lines/etc, mesh or size configurations, gear design, and marking of gear                                                                                             |
|                                                                               | <b>Boat controls</b> limit the size and engine capacity of boats                                                                                                                                                                                                                                                     |
| <b>Output controls limiting the amount and type of fish able to be landed</b> | <b>Total allowable catch</b> (TAC's) is a specified total catch for a share management fishery determined by an independent Total Allowable Catch Committee fished on a competitive basis or by people holding individual quotas.                                                                                    |
|                                                                               | <b>Species size limits</b> restricts the minimum size, maximum sizes or range of sizes specified for fish of a particular species that can be landed (by measurement or weight);                                                                                                                                     |
|                                                                               | <b>Bag limit</b> is the maximum quantity of fish of a specified species or of a specified class that a person may take on any one day. – daily limit.                                                                                                                                                                |
|                                                                               | <b>Possession limit</b> is the maximum quantity of fish of a specified species or specified class that a person may have in possession in any specified circumstances                                                                                                                                                |
|                                                                               | <b>Protected fish</b> are certain species of fish completely prohibited from being in a person's possession.                                                                                                                                                                                                         |
|                                                                               | <b>Protected fish from commercial fishing</b> are certain species of fish completely prohibited from commercial fishing and from taking for sale.                                                                                                                                                                    |
|                                                                               | <b>Quality assurance controls</b> are the controls on the harvest of shellfish such as mussels and pipis to protect health                                                                                                                                                                                           |
| <b>Protection of ecosystems</b>                                               | <b>Protected or threatened species, populations and ecological communities and their habitats</b> (eg fish, aquatic vegetation, marine mammals, platypus, birds etc). listed under the FM Act, NPW Act or EPBC Acts.                                                                                                 |
|                                                                               | <b>Marine protected areas</b> in estuarine or oceanic areas managed to conserve biodiversity and habitat. These include aquatic reserves, marine parks and marine components of national parks and nature reserves (Note: fishing restrictions may only apply in certain zones in marine parks and aquatic reserves) |
|                                                                               | <b>Planning controls</b> in Environmental Planning Instruments (eg LEPs, SEPPs) under the EP&A Act that could limit where fishing could occur and /or protect foreshore vegetation and wetlands from disturbance or destruction.                                                                                     |

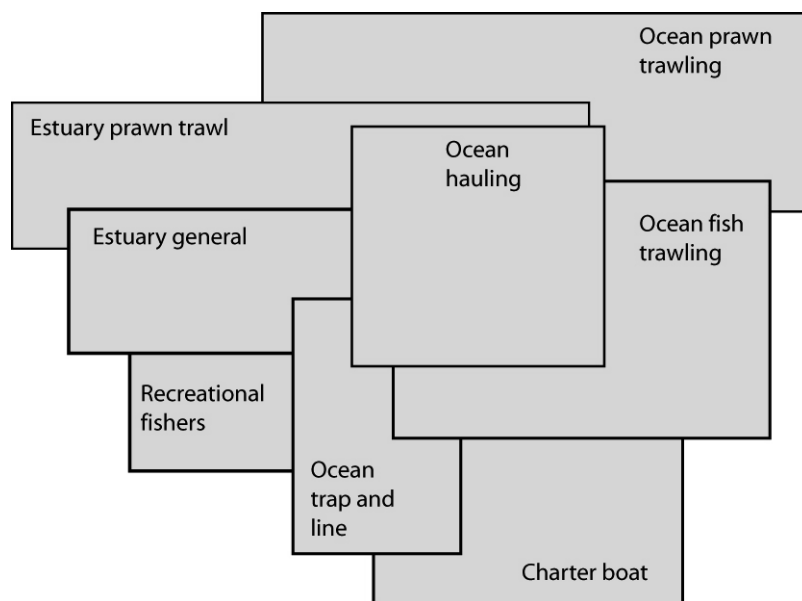
<sup>1</sup> Definition extracted from Metzner, R. & Rawlinson, P. (1998) Fisheries Structural Adjustment: towards a national framework. Commonwealth Department of Primary Industries and Energy, Canberra, p.2.



### ***Interaction between fisheries***

To understand the impacts on fish stock of a particular fishery, the interaction and cumulative impacts of other fisheries on the particular stock and habitats must also be considered. The nine major commercial fisheries have been defined principally on an historical basis in a manner convenient for management of the fishers and not the management of the fish stock. As the same fish stock may be fished by a number of fisheries, changing the controls in one fishery (say in the estuary prawn trawl) will affect the stock available to be caught in another (eg ocean prawn trawl). For some species, four or more commercial fisheries as well as recreational or charter boat fishers may be catching the same species often at different stages of their development.

**Figure 1 Potential interrelationship between fisheries**



Because of the level of interaction between fisheries (Table 2), the development of a strategy for a particular fishery as well as the associated environmental assessment must take into consideration the potential cumulative impacts of the management strategies on target species, by-product species (which may be the target species of another fishery) and bycatch as well as the potential social and economic effects as a result of any associated changes in resource allocation.

**Table 2 Interaction between fisheries based on  
NSW Fisheries 1998/1999 Status of Fisheries Resources Report**

| Species         | Exploitation status    | No of fishers taking 90% of catch | Tonnes landed in 1997/8 |             |                 |             |             |             |           |             |                     |
|-----------------|------------------------|-----------------------------------|-------------------------|-------------|-----------------|-------------|-------------|-------------|-----------|-------------|---------------------|
|                 |                        |                                   | Estuary Prawn Trawl     | Ocean Prawn | Estuary General | Ocean Haul  | Trap & line | Ocean Trawl | SEF C'wth | Purse Seine | Recreation Estimate |
| Yellowfin bream | Fully fished           | 225                               | Significant             | Significant | 315             | 115         |             |             | 400       |             |                     |
| Sea mullet      | Fully fished           | 101                               |                         |             | 1960            | 2442        |             |             |           |             | minimal             |
| Yellow tail     | Moderately             | 15                                |                         |             | Significant     | Significant |             |             |           | 473         | 24                  |
| Slimy Mackerel  | Moderately             | 10                                |                         |             | Significant     | Significant |             |             |           | 497         | 40                  |
| Snapper         | Fully / over fished    | 118                               | Significant             | Significant | Significant     |             | 271         |             |           |             | 180                 |
| King fish       | Fully / over fished    | 50                                |                         |             |                 |             | 73          |             |           |             | 50                  |
| Blue eye        | Fully / over fished    | 25                                |                         |             |                 |             | 105         | 100         | 400       |             | 10                  |
| Gem fish        | Over fished /collapsed | 15                                |                         |             |                 |             | 105         |             | 200       |             | 10                  |
| Silver trevally | Fully / over fished    | 68                                |                         |             | 92              |             | 112         | 34          | 240       |             | Very significant    |
| Prawns          | Fully fished           |                                   | 414                     | 954         | 799             |             |             |             |           |             | 266                 |

## B. The EIA Process and Procedures

### *Steps in the EIA Process*

The four steps below summarise steps in preparing and assessing a Commercial Fishery Management Strategy and in its review and updating.

#### **Step 1**

- NSW Fisheries assembles information– stock issues, habitat issues, current fishing practices and environmental impacts, threats and other issues to provide the basis for developing a draft FMS and for consulting on the scope of the EIS
- NSW Fisheries consults with the endorsement holders and MAC and identifies alternative management regimes and develops the first draft of the FMS
- NSW Fisheries consults with MAC and Advisory Council and develops the second draft FMS.

#### **Step 2**

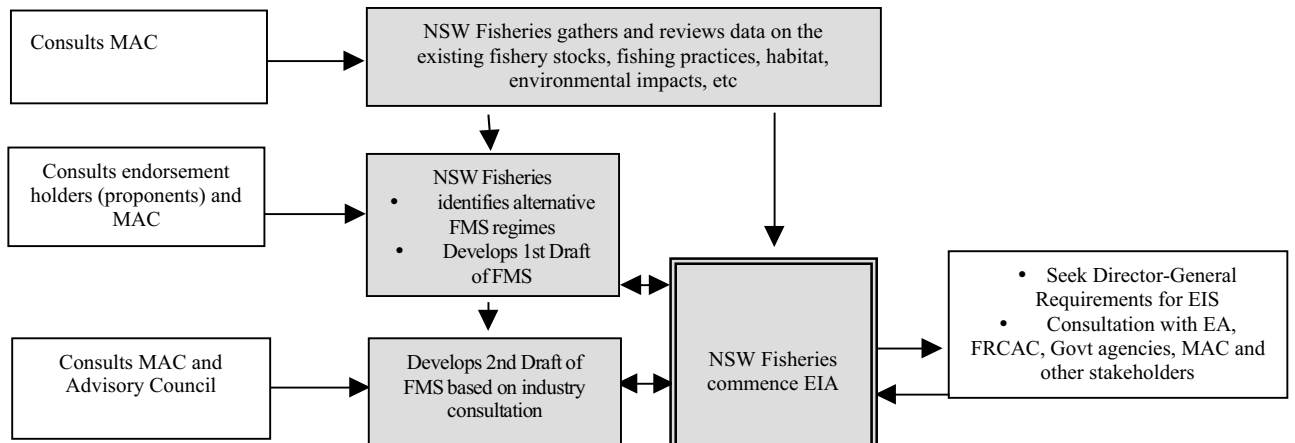
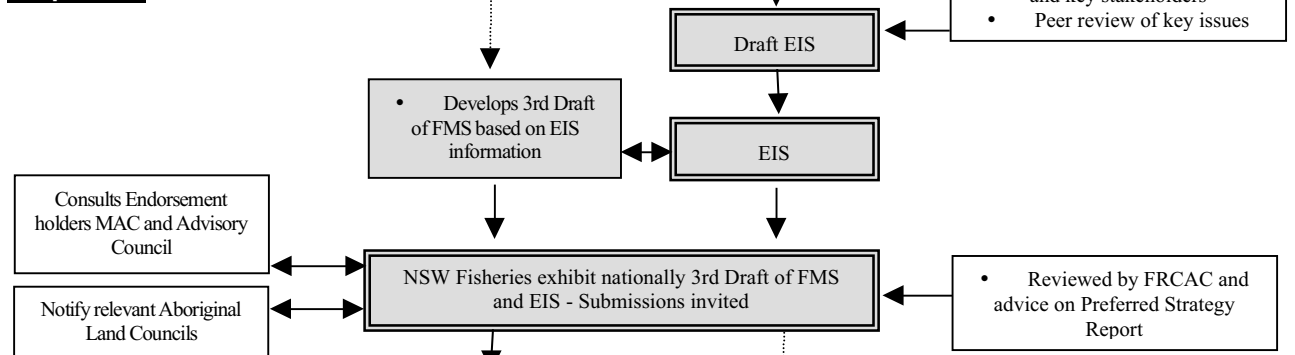
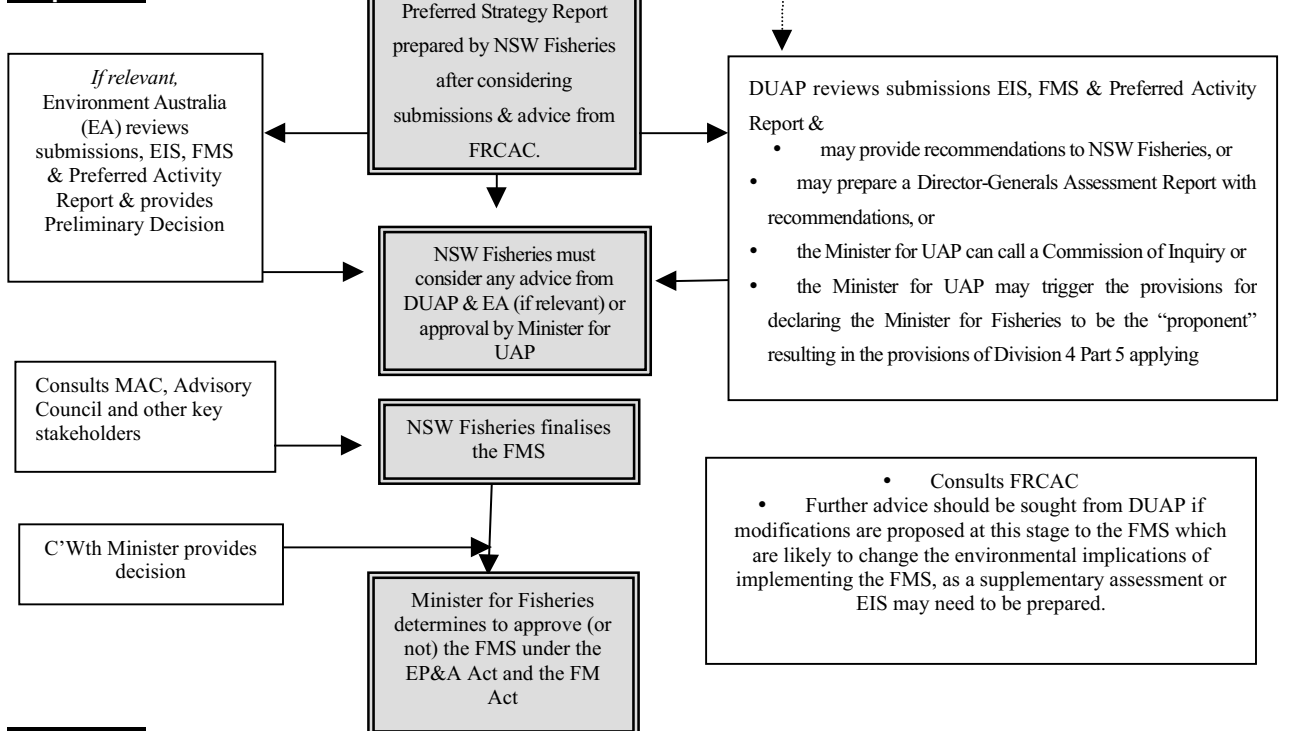
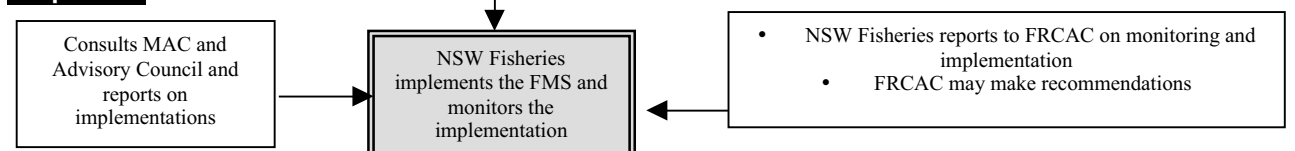
- NSW Fisheries consult DUAP for the Director-General Requirements to determine if there are additional matters to those in this Guideline for the assessment of the FMS. DUAP consults with EA, FRCAC, Government agencies, MAC and other stakeholders prior to issuing any additional requirements.
- NSW Fisheries assesses the impact on the environment of the draft FMS (and the fishing activities undertaken under it) within the terms of the Environmental Assessment Guidelines and any specific requirements issued by the Director General of DUAP. NSW Fisheries consults with FRCAC, EA and key stakeholders regarding the draft strategy and environmental assessment. NSW Fisheries organises for independent peer review of key components of the draft strategy and environmental assessment.
- NSW Fisheries exhibits nationally the EIS and the draft FMS for public comment. NSW Fisheries consults with FRCAC, and notifies and /or consults with endorsement holders, relevant Advisory Council and MAC, relevant Aboriginal Land Councils and other stakeholders. FRCAC may recommend modifications to the FMS as a result comments from stakeholders.

#### **Step 3**

- NSW Fisheries sends submissions received as a result of exhibition to DUAP and EA. NSW Fisheries reviews and if appropriate modifies the FMS in the light of the submissions and any advice from the FRCAC. NSW Fisheries prepares a Preferred Strategy Report outline the response to issues raised in submissions or by FRCAC and any proposed changes in the FMS as a result to improved the sustainability of the strategy
- DUAP reviews submissions, EIS, FMS and Preferred Strategy Report and may (i) provide recommendations to NSW Fisheries, (ii) prepare an Director-General's Assessment Report with recommendations or (iii) the Minister for UAP can call a Commission of Inquiry or (iv) the Minister for UAP may trigger the provisions for declaring the Minister for Fisheries to be the "proponent" resulting in the provisions of Division 4 Part 5 applying. In this case, the approval of the Minister for UAP is required for the FMS.
- If relevant, Environment Australia reviews the submissions, EIS, FMS and Preferred Strategy Report and provides a preliminary decision.
- NSW Fisheries reviews submissions and any advice received from DUAP or Environment Australia and determines whether the draft strategy should be recommended for approval. If an approval is required from the Minister for UAP or under C'wth legislation, the recommendation must be consistent with these approvals. If amendments to the FMS are proposed at this stage, NSW Fisheries may need to undertake a supplementary assessment (and approvals) if there are likely to be changes in the environmental impacts. If the changes are significant, the supplementary environmental assessment should be exhibited in accordance with Step 3.
- Commonwealth Minister makes a determination under Commonwealth legislation.
- Minister for Fisheries makes a determination under Part 5 of the EP&A Act and an approval of the finalised FMS under the Fisheries Management Act.

#### **Step 4**

- NSW Fisheries prepares relevant management plans and amends any existing management tools (eg regulations which are not consistent with the Strategy) necessary to give effect to the approved strategy. NSW Fisheries consults with FRCAC, relevant Advisory Councils, MACs and other stakeholders and if relevant the general community in finalising the management plans. Minister for Fisheries approves management plans.
- NSW Fisheries monitors the implementation of the Strategy and reports to FRCAC, relevant Advisory Councils, MACs and stakeholders on the resource and environmental management performance.
- NSW Fisheries reviews the Strategy or aspects of the strategy (based on triggers in the FMS).

**Figure 2 Steps in undertaking Environmental Assessment****Step 1****Step 2****Step 3****Step 4**

### ***A strategic approach in the assessment of fisher activities***

For each commercial fishery, the environmental impacts of issuing approvals under the provisions of the strategy are to be assessed in accordance with this guideline and the provisions of Division 5 Part 5 of the EP&A Act. The environmental assessment is to consider the impacts of the fishery as a whole rather than the impacts of individual fishers. However where there are regional/zone differences or peculiarities of particular systems such as lakes or estuaries, the impacts of the fishers within these areas should be identified and assessed.

The environmental assessment should test the sustainability of the proposed level of fishing activities authorised under the proposed fishery management strategy. This assessment must consider the cumulative implications of issuing approvals for the designated fishing activity along with interactions with the impacts of other fisheries on the fishery resources. The assessment must not only predict and consider the acceptability of the estimated impacts on target species, but must also consider effects on species taken incidentally, important habitat and the general environment. It must also consider the impact on the resource from other non-fishing related activities likely to affect the sustainability of the fishery.

The impact of commercial fishing on fish stocks (and in some cases the surrounding environment) to a lesser or greater extent depends on the management regime. The environmental assessment of the Strategy aims to identify the level of impact and the appropriate level of control of fishing activity that ensures the impact is acceptable and the fishery is sustainable. The EIS should consider the relative impact of different level and type of controls and justified the preferred approach on biophysical, social and economic grounds.

The environmental assessments must also consider along with other management rules in the strategy, the impacts of “responsive management” proposed to deal with situations when there is a need for changes in some of the “rules” in response to modified fishing activity or changed conditions eg when toxic blue green algae outbreaks in pipis. The assessment and approval of these responsive management components in the Strategy would provide for some flexibility without the need for further detailed assessment if management measures need to be changed during the life of the Strategy.

### ***Factors to be considered when preparing an EIS***

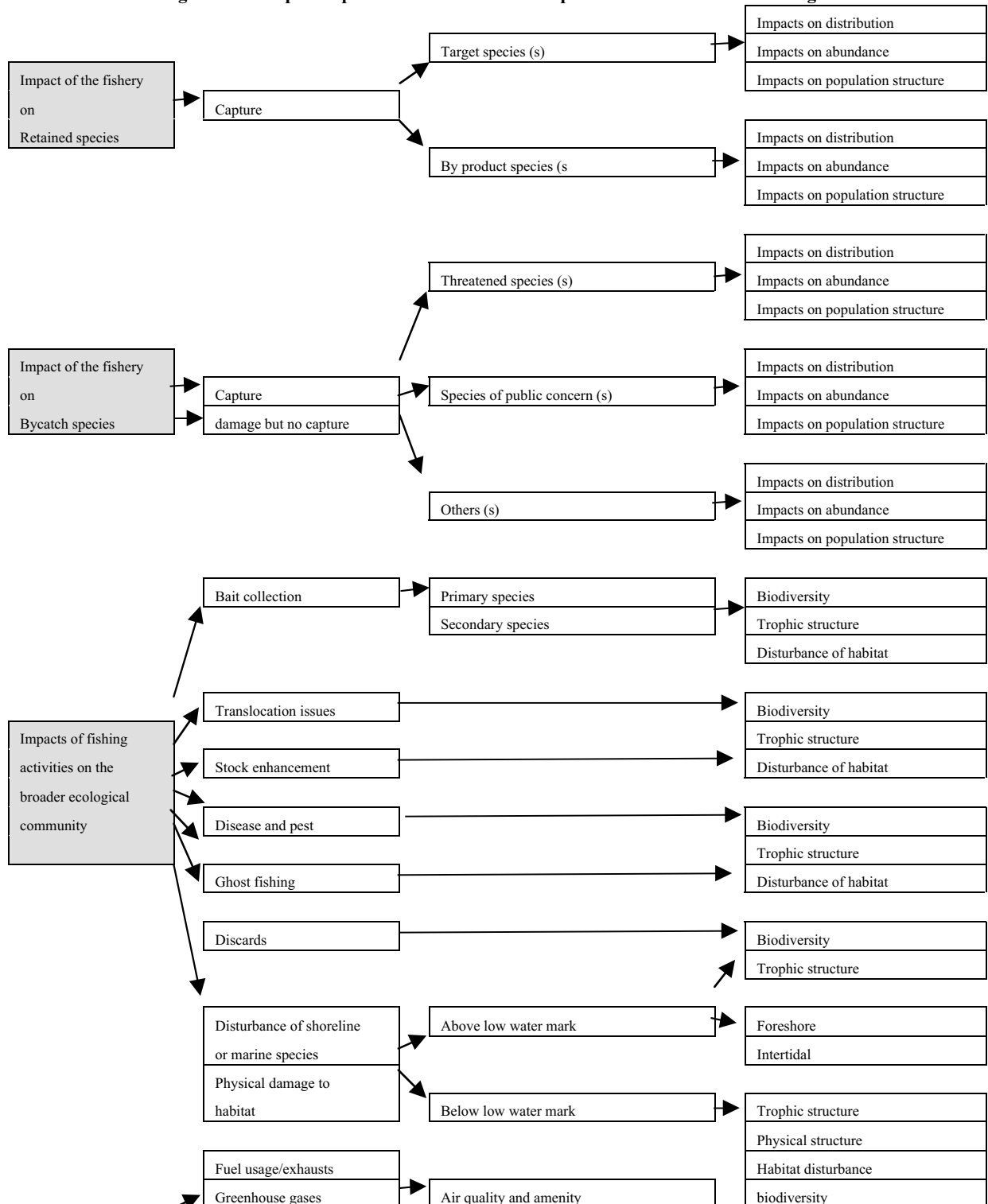
The Environmental Assessment Guidelines lists specific issues that are potentially important when assessing the impacts of the strategy and in fine-tuning management rules for the fishery. The issues listed are not exhaustive and the degree of relevance of each issue will vary with the type of commercial fishery.

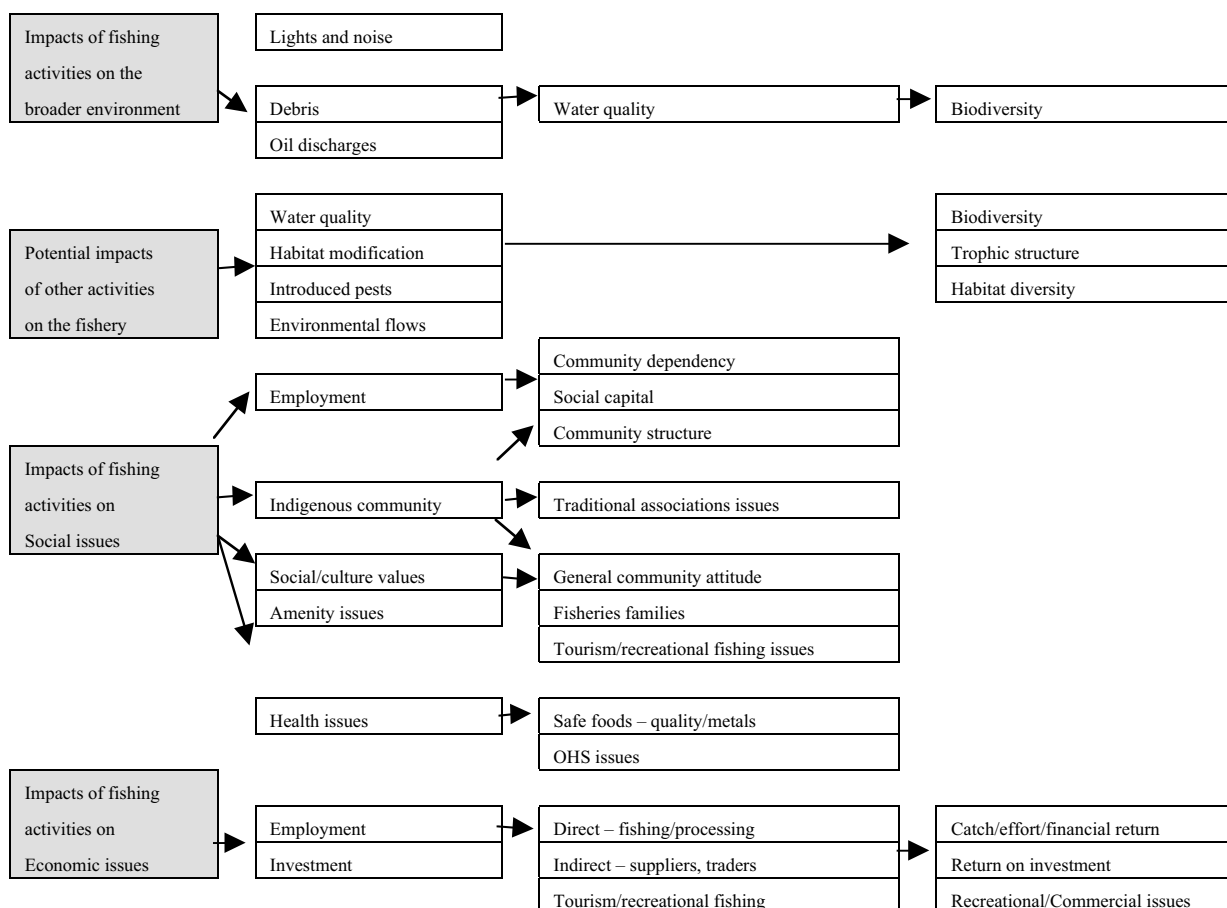
The term environment includes biophysical, economic and social aspects and hence broader issues in addition to a stock assessment must be considered in the environmental assessment. There is a general duty to consider the level of potential impacts on economic and social aspects as well as biophysical issues. The environmental assessment should deal with those issues of key importance to the particular fishery but should generally consider:

- Impacts of activation of latent effort or from effort shifts
- Bycatch reduction
- Impacts on retained, bycatch and bait species

- Impacts on the broader aquatic ecology, habitat and the environment
- Protection of key habitats and protected or threatened species
- Influences of other activities on the fishery
- Social issues associated with the fishery
- Economic issues associated with the fishery.

**Figure 3 Examples of potential environmental implications of commercial fishing**







The assessment should rely on the best available information to predict impacts. However where information is inadequate, the precautionary principle must be invoked and a cautious approach taken until such time as additional data collection, research and analysis can provide a sounder basis for management decision making. Nonetheless, when predicting the potential impacts, worst case scenarios should be considered as well as normal operational conditions.

General principles when undertaking assessment include:

- ◇ Available scientific information including catch and effort trends, information from any scientific study sites, estimates of the catch of user groups (where possible), and the life history, distribution and dynamics of the fished stock/s should be used in predicting likely impacts on stock/species and likely effectiveness of management tools/measures.
- ◇ Impact prediction should consider magnitude, duration, extent, direct and indirect effects, beneficial and adverse effects and whether impacts are reversible or permanent.
- ◇ The assessment should take into account regional/zone differences and seasonal effects.
- ◇ The assessment should take into consideration the potential impact on habitat, habitat fragmentation and broader biodiversity issues and any peculiarities of particular fished habitats, such as lakes or estuaries,
- ◇ Environmental risks and uncertainties in predicting impacts should be clearly stated including the levels of confidence in predictions and the likely resilience of the environment to recover from impacts
- ◇ In the absence of quantitative data, qualitative or delphic impact assessments (ie. categorisation into high, medium or low) based on best available information and uncoded expertise should be used.
- ◇ The proposed management measures for resource allocation and to mitigate impacts should be justified taking into consideration the ESD principles.

### ***Overview of the environmental impact assessment***

The following matters should be addressed in the environmental assessment of a Commercial Fishery Management Strategy (FMS) and the designated fishing activities described in the FMS:

1. Describe the existing fishery (including any existing “rules”, current management plans, historical events, seasonal patterns and marketing factors likely to affect fisher behaviour)
2. Describe the proposed regime under the FMS including its aims, objectives and proposed management rules (including any draft management plan)
3. Consider alternative regimes (including alternative aims, objectives, management rules and interactions with other fisheries)
4. Assess the impacts of implementing the FMS taking into consideration past performance of the fishery, likely future performance, interactions with other fisheries, broader environmental issues and feasible alternative regimes. For each resource or environmental issue, the following should be provided

- a description of the existing resource, habitat and environmental conditions (baseline conditions)
  - analysis of the potential impacts of implementing the strategy, indicating the level of confidence in the predicted outcomes and the resilience of the environment to change; indicate if the impacts are unknown, unpredictable, short term/long term or irreversible *Note: where the impacts are likely to be minor, qualitative analysis is adequate. With each issue, the level of detail should match the level of importance of the issue in decision-making.*
  - the measures available/proposed to mitigate impacts (eg responsive management options) and the level of confidence that the measures proposed would effectively mitigate/ manage the impacts.
  - the procedures to be used to monitor whether impacts occurring and if so, whether they are at the frequency and magnitude predicted.
5. Identify performance indicators, triggers for reviewing the FMS and the proposed monitoring regime for measuring the likelihood of the strategy meeting the objectives of the FMS, including an assessment of the adequacy or appropriateness of the indicators, triggers and monitoring regime.
6. Justify the draft commercial FMS and its management arrangements in terms of biophysical, economic and social factors and the principles of ecological sustainable development.

## **C. The contents of the EIS for a Draft Commercial FMS**

### *(A) EXECUTIVE SUMMARY*

An executive summary should be provided and should be available separately for public information. The summary should give a short overview of the draft fishery management strategy and the potential environmental impacts of fishing authorised by the strategy. It should be written in non-technical language to facilitate understanding of the proposal by the general public.

### *(B) REVIEW OF THE EXISTING OPERATION OF THE FISHERY*

#### **1. The fish stock**

Identify current fish stock parameters of the fishery including:

(a) Identify fish stock harvested and affected by the fishery –including:

- target species and by-products species – retained species
- by catch (non-retained);
- bait species

(b) Review the status of the fish stock and identify the status of the species in terms of under-fished, fully fished, over-fished/depleted or uncertain – also consider whether by-product or by-catch species are protected or threatened species or species of public concern (eg blue groper). Discuss the trends in the health of the fish stock and the major influences on these trends

(c) Identify the species that are target species of other fisheries and any existing conflicts with other fisheries.

#### **2. Existing operational area/regions**

Outline the current locational parameters of the fishery including:

(a) Identify the principal areas including any “zones” within the areas and their importance for management purposes; identify any priority fishing areas (which may be identified as recognised fishing grounds)

(b) Identify ports or locations where fishers operate from:

- ♦ identify the existing level of capital investment in on-shore support, processing or distribution facilities in particular ports/regions and its importance for the fishery;
- ♦ identify any existing fishers organisational arrangements (eg co-operatives) and their importance
- ♦ identify any current hazard issues affecting the use of the ports or locations where fishers operate

(c) Identify and discuss importance of any relevant jurisdictional issues (eg. Offshore Constitutional Settlement, interstate issues) or any areas where fishing has been restricted all or some of the time eg closures areas, reserves and marine parks (protected zones), navigation channels, naval waters, etc

- (d) Identify and discuss importance of any areas of important aquatic habitats for the fishery (life cycle related) and those vulnerable to impact by fishing methods authorised under the strategy or by land-based activities;
- (e) Identify any discrete fished habitats, such as lake systems, estuaries or specific reefs and identify any operations, environmental conditions or constraints that are peculiar to these areas.

### **3. Current fisher and harvest information**

Outline current fisher information including:

- (a) identify the number of fishers and number and type of endorsements on a State, regional and/or sub-regional basis
- (b) identify the total employment within the fishery on a State, regional and/or sub-regional basis, including those involved in onshore handling/processing/value-adding arrangements
- (c) identify the gear, equipment or boats involved in the fishery including:
  - (i) if relevant, identify the number, size, age and characteristics of boats and on-board handling/processing arrangements;
  - (ii) identify the characteristics of fishing gear – including its use and management – cleaning, maintenance, waste management – and any innovations to minimise bycatch
  - (iii) identify current trends in capital investment in boats, gear and equipment within the fishery including any which influence the efficiency of catch or to increase the reliability of monitoring the catch (GPS, echo-sounders, VMS etc)
- (d) outline information on the current harvest on a State, regional and/or sub-regional basis:
  - (i) current catch, value and trends including:
    - ♦ species information – target species as well as species in the incidental catch which is retained (by-product) or discarded (bycatch), identify stages in the life cycle of target and incidental catch;
    - ♦ recent trends in total fishing effort and total landed value of the catch;
    - ♦ outline any processing of the catch (and benefits derived from activities)
  - (ii) seasonal and other major factors that affect how the fishery currently operates and the trends in distribution of the catch within the region and between the fishers
  - (iii) identify other commercial and recreational fisheries for which these species are target or incidental catch; outline characteristics of other fisheries and outline resource exploitation (eg. catch levels and participation of other sectors)
  - (iv) indicated the information sources of the fishery and the reliability of data and what uncertainties (if any) are associated with the data

### **4. Current regulatory and management measures**

Outline the range of management tools currently used to limit or regulate the impacts of the fishery; such as

- (i) Limits on who has access

- (ii) Limits on where and when the fishing can occur
  - (iii) Input controls limiting the equipment used to take fish
  - (iv) Output controls limiting the amount and type of fish able to be landed
- (b) Describe the provisions in any existing management plans and its objectives
- (c) Comment on the strengths and weaknesses of the current management regime
- (d) Describe the current administrative arrangements for the fishery and comment on the strengths and weaknesses of the current regime including:
  - (i) enforcement and compliance
  - (ii) cost recovery,
  - (iii) community contribution payments (if a share management fishery),
  - (iv) cross-fishery consultation

## **5. Factors outside the fishery affecting the fishery**

- (a) Interaction with other fisheries under NSW jurisdiction
- (b) Interaction with other fisheries under other State or Commonwealth jurisdiction
- (c) Environmental factors – climatic/season changes; water quality; habitat degradation; etc

## *(C). THE DRAFT COMMERCIAL FISHERY MANAGEMENT STRATEGY*

### **1. Objectives of the FMS**

The objectives of the management strategy should be clearly stated and include the following issues:

- (i) Maintenance of ecologically viable stock levels with acceptable levels of probability. Where stocks are overfished, the fishery will be managed to rebuild stocks to viable levels within nominated timeframes.
- (ii) Conservation of biological diversity in the ecosystem and the protected or threatened species, populations or communities and their habitats
- (iii) Protection of the ecosystem in particular key habitat areas
- (iv) Fishing operations are not a threatening process to bycatch species
- (v) Responsible stewardship in the management and harvesting of fishing resources including the accountable management of latent effort and bycatch reduction

### **2. Designated fishing activity**

#### **2.1 Fish stock affected by the FMS**

Outline the proposed fishing parameters for the FMS, including:

- (a) Identify the fish stock to be harvested and affected by the fishery –including:

- (i) target species and by-products species – retained species
- (ii) by catch (non-retained);
- (iii) bait species

Identify the status of the species in terms of under-fished, fully fished, over-fished/depleted or uncertain – also consider whether by-product or by-catch species are protected or threatened species or species of public concern.

- (b) Identify if species are target species of other fisheries.
- (c) Estimate future trends in harvest levels across all fisheries for key fish species based on stock trends.

#### **2.2 Operational area/regions of the FMS**

Identify the proposed operational area/regions of the FMS including:

- (a) Identify the principal areas including any “zones” within the areas and their importance for management purposes (including relevant maps); identify any priority fishing areas (and whether they are or are to be identified as recognised fishing grounds)
- (b) Identify ports or locations where fishers operate under the FMS will operate from

- (c) identify and discuss importance of any relevant jurisdictional issues for the FMS (eg. Offshore Constitutional Settlement)
- (d) identify any areas where fishing is to be restricted all or some of the time eg closures areas, reserves and marine parks (protected zones), navigation channels, naval waters, etc (including relevant maps).
- (e) identify and discuss the importance of any key aquatic habitat areas for the fishery (life cycle related); identify areas vulnerable to impact by fishing methods authorised under the strategy or by land-based activities; identify any measures in the FMS in relation to these areas

## **2.3 Proposed harvesting strategy – Resource allocation under the FMS**

- (a) Describe the proposed sustainable harvest strategy including the allocation of resources within/between user groups to meet the FMS objectives, taking into consideration:
  - (i) the proposed sustainable harvest levels based on stock trends and past catch and effort trends,
  - (ii) the proposed number of endorsement holders and the proposed harvest strategy to limit catch
  - (iii) the level of resource exploitation by other commercial and recreational fishers
- (b) Outline the entitlements that are proposed to be issued in the management strategy including any classes of shares and rules relating to those shares

## **3. Interaction between fisheries**

- (a) Identify the interaction between fisheries/fishers and the extent of interaction in terms of :
  - (i) fishers holding endorsements in more than one commercial fishery
  - (ii) target and other species taken by more than one fishery
  - (iii) key fishing areas common to more than one fishery – time and location issues
- (b) Describe any sources of conflict between fisher and outline any measures to reduce conflict between fisheries
- (c) Outline any potential for improving the management of the fishery and the sustainability of the stock by changes in arrangements between fisheries
- (d) Outline any potential for improving the management of the fishery and the sustainability of the stocks by changes in arrangements between fisheries and non-consumptive users

## **4. The regulatory controls and management measures to apply under the FMS**

- (a) Outline management measures to be applied under the FMS relating to the following:

For *under fished* or *fully fished* stock: describe management measures required to ensure that the fishery remains sustainable

For *overfished* or *depleted* stock: describe the strategy proposed to promote recovery in overfished or depleted stock

For a stock of *uncertain status*: identify the management measures required to ensure that the fishery remains stable.

- (b) Outline the proposed management tools (see Table 1/Appendix 1) and measures to apply under the FMS to implement the harvesting strategy and achieve the objectives of the FMS. These measures may include all or some of the following:

(i) Provisions in the Fisheries Management Act or Regulations including

- any eligibility or transfer rules; gear specifications – number and size of gear ; protected fish; species size limits on primary species; recognised fishing grounds
- Any management plan or draft management plan including catch limits or quotas
- Fishing closures including time and area closures and emergency response closures; aquatic reserves, recreational fishing areas or other protected areas
- Any determinations of the TAC Committee under Division 4 of Part 2 of the FM Act

(ii) Any relevant bycatch or threatened/protected species action or recovery plans

(iii) Any relevant provisions in environmental planning instrument

(iv) Quality assurance program for the harvest and management of fish, shellfish etc

(v) Any other State, National or International agreements relevant to the management of the fishery and its environmental impacts and the agencies responsible for administration

- (c) Outline the contingency measures, responsive management strategies or/and mitigation measures to be undertaken if:

(i) “trigger for contingency action” are reached;

(ii) health issues or adverse ecological or habitat issues arise; or

(iii) new technology, methods or practices evolve so that some change to the management rules would be beneficial to the sustainability of the stock and associated ecosystem.

- (d) Describe the administrative mechanisms for the fishery including:

(i) enforcement and compliance,

(ii) cost recovery,

(iii) community contribution payments (if a share management fishery),

(iv) cross-fishery consultation.

- (e) Describe measures to improve the environmental and resource management performance of fishers including

(i) the development of a code of practice, education/awareness programs and /or capacity building programs

(ii) the strengthening of fisher reporting and monitoring



## 5. Monitoring and Responsive Management

- (a) Identify performance indicators to monitor whether the objectives of the strategy are being achieved and “triggers for review” of the strategy based on the performance indicators when the FMS requires review.
- (b) Identify “triggers for contingency action” (eg annual catch, size structure of catch, minimum key habitat available) for fish stock based on categories of *under-fished*, *fully fished*, *over-fished/depleted* or *uncertain* and bycatch to deal with situations when there are unusual events when additional contingency management intervention would be required to ensure that the fishery remains sustainable
- (c) Outline of monitoring programs (in place or planned) for the FMS. The monitoring program should be linked to performance indicators, triggers, management rules and the research program and include:
  - (i) Monitoring program to monitor whether:
    - the objectives of the strategy are being achieved (ie. based on the performance indicators); and
    - environmental impacts are occurring and if so, whether they are at the frequency and magnitude predicted;
  - (ii) Monitoring program specifically to monitor fish stock based on categories of under-fished, fully fished, over-fished/depleted or uncertain.
  - (iii) For a stock of uncertain status, outline the program proposed to gather sufficient information to provide a scientific reliable assessment of the status of the stock
  - (iv) Monitoring information required for research programs to provide information relevant for continuous improvement in fisheries management.

## 6. Proposed Research Programs

A research program must be developed as part of the Management Strategy. The program must indicate strategies to enable appropriate research to be undertaken. The program must:

- (a) Identify areas where further information is needed including improving knowledge of the stock and ecosystems upon which the fishery depends. Indicate whether the information is fishery dependent or independent.
- (b) Specify short-term and long-term aims and objectives of the research
- (c) Identify links with monitoring and continuous improvement/responsive management programs.

## **D. CONSIDERATION OF ALTERNATIVE MANAGEMENT REGIMES**

### **1. Outline feasible alternative to those proposed in the Draft FMS**

Include alternative:

- (a) characterisation of the fishery, including:
  - (i) its methods of fishing,
  - (ii) target species,
  - (iii) relationship with other commercial fisheries
- (b) numbers of fishers/shares and licensing/ endorsement regimes
- (c) the objectives of the FMS
- (d) management measures proposed in the FMS
- (e) performance indicators and triggers for review
- (f) monitoring regimes
- (g) research programs

### **2. Assess the effectiveness of these alternatives compared to the proposal in the Draft FMS**

Assess alternatives in terms of the following issues:

- (a) Maintenance of ecologically viable stock levels with acceptable levels of probability
- (b) Rebuild stocks to viable levels within nominated timeframes where stocks are overfished
- (c) Conservation of biological diversity in the ecosystem and the protected or threatened species, populations or communities and their habitats
- (d) Protection of the ecosystem in particular key habitat areas
- (e) Fishing operations not being a threatening process to bycatch species
- (f) Responsible stewardship in the management and harvesting of fishing resources including:
  - (i) the accountable management of latent effort
  - (ii) bycatch reduction

### **3. Justify the selection of the preferred options in the Draft FMS.**

## **E. IMPACT ON THE FISH RESOURCES**

### **1. Retained species – Target and Byproduct species**

- (a) Outline the current knowledge of the health of target and non-target species and dependent/associated species; identify the status of the fish stock in terms of under-fished, fully fished, over-fished/depleted or uncertain.
- (b) Provide a species stock assessment including an outline of the robustness of estimates for all parameters used in the analyses and of the reliability of the model used where possible including information on:
  - (i) stock levels and dynamics – target species and by-product species
  - (ii) population structure (eg. size and age structure) and life cycle behaviour
  - (iii) spatial and temporal distribution – location in periods of vulnerability
- (c) Describe the effect of implementation of the strategy (including the proposed fishing rules and other management measures) on the species including an outline of the robustness and reliability of estimates for all parameters used in the analyses. Indicate the potential yields and resource status
  - (i) Consider yields/resource status under the proposed harvesting strategy in the FMS compared with different harvesting strategies;
  - (ii) Outline level of confidence in predictions regarding the health of the stock;
  - (iii) Identify key factors affecting stock sustainability: Where possible include information on:
    - past management regimes for this fishery – including trends in fisher numbers and practices;
    - the cumulative historic and current catch rates by all relevant sectors: commercial, recreational and indigenous; consider the appropriateness of “catch rate” rules in achieving objectives compared with alternatives
    - the cumulative historic and current fishing effort by all relevant sectors: commercial, recreational and indigenous; efficiency in achieving the catch rate given the rules relating to type of boat, gear and other rules; consider the appropriateness of “effort” rules in achieving objectives compared with alternatives
    - historic and current locational restrictions by relevant sector; appropriateness of restricted areas or recognised fishing grounds in resource allocation and in achieving the objectives; consider the appropriateness of “locational” rules in achieving objectives compared with alternatives
    - the resilience of the stock to fishing pressure from this fishery in particular the affect of the harvest regime (methods, timing, location) at the particular stage in the species life cycle;

- other factors such as boating activities, aquaculture, shipping activities or other urban and tourist activities affecting stock numbers and resilience.
  - (iv) Identify the likelihood of any species becoming “over exploited” under the proposed fisheries rules given the current level of fishing mortality from all commercial fisheries or recreational fishing sectors where the same species might be harvested or affected and the likely implication for maintaining a sustainable harvest in this fishery
- (d) Assess the appropriateness of the proposed management rules or measures to allocate the resources within/between user groups in terms of achieving the strategy’s objectives and in terms of ESD including:
- (i) outline eligibility criteria; transfer rules; gear specifications – number and size of gear; protected fish provisions; time and area closures - restricted fishing areas (plus closure contingencies); zoning/region arrangements; species size limits on primary species; catch limits or quotas; recognised fishing grounds.
  - (ii) consider the effectiveness of the management rules or measures under the proposed harvesting strategy in the FMS compared with alternative management rules or measures;
- (e) If stocks are fully fished or over-fished/depleted or uncertain:
- (i) assess the adequacy of the proposed stock management strategies to maintain a sustainable harvest
  - (ii) assess the adequacy of the proposed stock recovery strategies or relevant threat abatement plans or recovery plans
  - (iii) consider the likelihood of “over exploited” species recovering under the proposed fisheries rules given the interaction with other fisheries.
  - (iv) consider the adequacy of the proposed program to gather information to provide a scientifically reliable assessment of the status of the “uncertain status” stock; and to identify what triggers would be needed to specify when management intervention would be required to ensure that the fishery is sustainable.
- (f) provide a summary of the uncertainty associated with the management of target and byproduct species and analysis of the consequence
- (g) identify the precautionary management measures current/proposed to mitigate, rehabilitate and /or compensate for the ecological impacts (eg responsive management options) and the level of confidence that the measures proposed would effectively manage the impact and associated risks. In particular state any judgement about the significance and acceptability of that impact
- (h) indicate the level of confidence in achieving the predicted outcomes and the resilience of the environment to change; indicate if the impacts are unknown, unpredictable, short tem/long term or irreversible.
- (i) consider the adequacy and appropriateness (compared with feasible alternatives) of the proposed monitoring program (in particular for over exploited or fully exploited species)
- (j) consider the adequacy and appropriateness (compared with feasible alternatives) of research proposals to provide relevant information to improve the management of particular species or the fishery in general.

- (k) assess the acceptability of the proposed measures on the sustainability of the ~~harvest~~ stock. In reaching a conclusion, the cumulative impacts of other fishing and activities leading to the mortality of these species should be considered.

## **2. Bycatch (non retained) species**

- (a) Describe by fishing gear/method type, the potential impact of the proposed fishing activity on bycatch species, in particular:
- describe the impact of direct capture (discard species, including juveniles of primary species) including, species composition, catch level and mortality rates
  - describe the impact of physical contact (not captured) including species potentially impacted and the extent of the impact and the predicted mortality rates of incidental contact
  - describe the impact of lost gear (ghost fishing) including the level of occurrence and estimate of potential catch rates
    - (i) For each of the above, predict the likely mortality/injury rates on the species
    - (ii) For each of the above, consider the level of likely mortality/injury rates on the above species from other commercial fisheries or fishing sectors (eg recreational fishing) where the same species might be harvested or affected
    - (iii) For each of the above, nominate a indicator group of bycatch species to be monitored
- (b) Identify feasible alternatives likely to reduce impacts on bycatch. Consider relevant matters in the National Policy on Fisheries Bycatch and bycatch action strategies developed under that policy
- (c) If bycatch species are fully fished or over-fished/depleted or uncertain:
- (i) assess the adequacy of the proposed bycatch reduction strategies; assess the adequacy of the proposed threat abatement plans or recovery plans
  - (ii) consider the likelihood of “over exploited” bycatch species recovering under the proposed fisheries rules given the interaction with other fisheries.
  - (iii) consider the adequacy of information to provide a scientifically reliable assessment of the status of the “uncertain status” bycatch species
- (d) provide a summary of the uncertainty associated with the management of bycatch and non-retained species and analysis of the consequence
- (e) identify the precautionary management measures current/proposed to mitigate, rehabilitate and /or compensate for the ecological impacts (eg responsive management options) and the level of confidence that the measures proposed would effectively manage the impact and associated risks. In particular state any judgement about the significance and acceptability of that impact
- (f) indicate the level of confidence in achieving the predicted outcomes and the resilience of the environment to change; indicate if the impacts are unknown, unpredictable, short tem/long term or irreversible.

- (g) Consider the effectiveness of the proposed management measures in this fishery management strategy in reducing or eliminating adverse environmental impacts and assess the acceptability of the proposed measures. In reaching a conclusion, the cumulative impacts of other fishing and other activities leading to the mortality of these species should be considered.

### **3. Bait resources**

Outline the use of bait species in the fishery, in particular:

- (a) Identify the species and volume of bait; identify source of bait –
  - (i) for bait collected in NSW waters, assess the impact of the collection of those species on the respective stocks and the ecosystem<sup>2</sup>.
  - (ii) for bait sourced from elsewhere, assess the impacts of the use of the species and the likely introduction of disease or pest species.
- (b) Identify feasible alternatives likely to reduce impacts. Consider the effectiveness of the proposed management measures in reducing or eliminating adverse impacts and assess the acceptability of the proposed measures.

### **4. Data requirements in relation to the assessment of the impacts on the fish resources**

- (a) Provide reference to technical data and other information relied upon to assess impacts; indicated its reliability and what uncertainties (if any) are associated with the use of the data in the assessment of the FMS
- (b) Identify where there are gaps in knowledge important for the assessment of the impacts of the fishery
- (c) detail a timetable for developing the data sets important for understanding longer term resource issues.

## **F. IMPACT ON THE BIOPHYSICAL ENVIRONMENT**

### **ECOLOGICAL ISSUES**

#### **1. Biodiversity and habitat Issues**

Describe the effects of the implementation of the strategy on biodiversity and their habitats, in particular:

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<sup>2</sup> If bait is collected from a major commercial fishery that is also to be assessed under Part 5 of the EP&A Act, refer to that other assessment.

- (a) Identify the key habitat areas and characteristics within the fishing region or subregion including important areas/features such as reefs, seamounts, channels, major seagrass beds and major underwater landscape characteristics;
- (i) Consider the habitat importance to ecological communities and populations and aquatic flora and fauna species that may be directly or indirectly affected by the fishing activities; indicate the local and regional scarcity of these habitats. In particular identify any the habitat issues associated with marine mammals and migratory birds
  - (ii) identify areas of high marine biodiversity/conservation significance; if relevant identify the following, indicating their incidence in the area of the fishery:
    - marine parks, aquatic reserves or closure areas protected under the Fisheries Management Act 1994, NPWS Act 1974 or Marine Parks Act 1997
    - other areas such as RAMSAR wetlands, Japan Australia Migratory Bird Agreement (JAMBA), China Australia Migratory Bird Agreement (CAMBA), World Heritage Areas or areas registered in the National Estate or State Heritage Register.
  - (iii) consider the appropriateness of reserving certain additional areas of significance in the lifecycle of the fishery or of high conservation status for biodiversity conservation and identify any such areas and options for the management of these areas
- (b) identify at a regional level the degree of habitat damage from fishing methods, foreshore access and boating activities;
- (i) list and assess the likely impacts from particular fishery methods, techniques, effort levels etc on the substrate;
  - (ii) consider impacts as a result of habitat destruction or disturbance on the mortality of species, by affecting species in the food chain, by changes in water quantity, quality or regime, deposition of sediments or by introducing obstructions to the free movement of species
  - (iii) consider the impacts of habitat disturbance or damage in discrete fished habitats such as lake systems, estuaries or specific reefs
  - (iv) assess the potential impacts on species, populations or ecological communities by changing or disturbing habitats in terms of local impacts as well as the broader context relevant for particular species,
- (c) identify and describe the benthic, ecologically related, associated or dependent species and water column communities affected by fishing operations or loss of habitat including the relationship to fishing frequency; if impacts are likely to be significant on benthic and other communities, using the best available information, map and define the level of substrate disturbance for each fishing method. Consider
- (i) what percentage of the total habitat area is likely to be affected;
  - (ii) how important is the habitat to other species and why;
  - (iii) how vulnerable is the species when it is associated with the habitat. Where possible, quantify the proportion of the habitat type represented in marine protected areas.
  - (iv) assess the acceptability of the impacts in terms of ecologically sustainability objectives.

- (d) provide a summary of the uncertainty associated with the management of biodiversity and habitat issues and analysis of the consequence
- (e) identify the precautionary management measures current/proposed to mitigate, rehabilitate and /or compensate for the ecological impacts (eg responsive management options) and the level of confidence that the measures proposed would effectively manage the impact and associated risks. In particular state any judgement about the significance and acceptability of that impact
- (f) indicate the level of confidence in achieving the predicted outcomes and the resilience of the environment to change; indicate if the impacts are unknown, unpredictable, short term/long term or irreversible.
- (g) Consider alternate management measures including contingency measures if monitoring indicates that action should be triggered. Assess the appropriateness of the mitigation measures including:
  - (i) timing of fishery activities to minimise disturbance;
  - (ii) location of fishing operations to minimise impacts on native species life-cycle, movement or migration.
  - (iii) permanent or temporary restrictions on fishing activities in key habitat areas.
- (h) Identify where there are gaps in knowledge important for the assessment of the impacts of the fishery and detail a timetable for developing the data sets important for understanding longer term biodiversity and habitat issues.

## **2. Threatened and Protected Species**

- (a) Identify any protected and threatened species, populations and ecological communities and their habitats listed under Threatened Species Conservation Act, Fisheries Management Act, National Parks and Wildlife Act or Environment Protection and Biodiversity Conservation Act (this may include invertebrates, fish, reptiles, birds, mammals, plants, algae, etc) which may be affected by fishing activities. Provide information on the habitats of threatened or protected species.
- (b) Assess the impact of the proposed fishing activity on the protected or threatened species, populations and ecological communities and their habitats from direct capture or from disturbance. In particular:
  - (i) provide information on incidental capture rates and mortality
  - (ii) provide information on habitat disturbance or loss
  - (iii) provide information on indirect impacts such as noise disturbance, boat strikes or disruption to behaviour
  - (iv) assess impacts of fishing on protected or threatened species, taking into account any relevant measures forming part of any recovery plan activities.
- (c) the following factors must be taken into account in deciding whether there is likely to be a significant effect on protected or threatened species, populations or ecological communities, or their habitats (*The 8 Part Test*)



- (i) in the case of a protected or threatened species, whether the life cycle of the species is likely to be disrupted such that a viable local population of the species is likely to be placed at risk of extinction,
  - (ii) in the case of an endangered population, whether the life cycle of the species that constitutes the endangered population is likely to be disrupted such that the viability of the population is likely to be significantly compromised,
  - (iii) in relation to the regional distribution of the habitat of a protected or threatened species, population or ecological community, whether a significant area of known habitat is to be modified or removed,
  - (iv) whether an area of known habitat is likely to become isolated from currently interconnecting or proximate areas of habitat for a protected or threatened species, population or ecological community,
  - (v) whether critical habitat will be affected,
  - (vi) whether a protected or threatened species, population or ecological community, or their habitats, are adequately represented in conservation reserves (or other similar protected areas) in the region,
  - (vii) whether the development or activity proposed is of a class of development or activity that is recognised as a threatening process,
  - (viii) whether any protected or threatened species, population or ecological community is at the limit of its known distribution.
- (d) provide a summary of the uncertainty associated with the management of threatened and protected species, populations and ecological communities and analysis of the consequence.
- (e) identify the precautionary management measures current/proposed to mitigate, rehabilitate and /or compensate for the ecological impacts (eg responsive management options) and the level of confidence that the measures proposed would effectively manage the impact and associated risks. In particular, state any judgement about the significance and acceptability of that impact
- (f) indicate the level of confidence in achieving the predicted outcomes and the resilience of the environment to change; indicate if the impacts are unknown, unpredictable, short term/long term or irreversible.
- (g) discuss the effectiveness of mitigation measures in particular of measures to protect species listed under Threatened Species Conservation Act , Fisheries Management Act or Environment Protection and Biodiversity Conservation Act (this may include invertebrates, fish, reptiles, birds, mammals, etc)

Note: The “8 Part Test” under s5A of the EP&A Act must be used by the determining authority in deciding whether there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats. The 8 Part Test provides guidance on determining when a species impact statement (SIS) is required. An SIS must accompany any proposal where there is likely to be a significant effect on threatened species, populations or ecological communities or their habitats.

### **3. Trophic structure**

Consider the effects of fishing on trophic structure (food webs) and where possible provide an ecological systems model, in particular:

- (a) identify the species that are likely to be affected directly or indirectly by the fishing activity,
- (b) identify likely productivity/flows and assess the impacts of removal of predators, prey or competitors
- (c) identify and assess food provisioning (from discards), especially for marine mammals, penguins and other birds
- (d) identify the risks and uncertainties of the fishery disrupting the trophic structure and identify the management measures to address these risks. Discuss the likely effectiveness of mitigation measures.

### **4. Translocation of organisms and stock enhancement**

Outline any potential impacts on the environment from the translocation of organisms (transference of stock species, fouling organisms and other pests) in particular:

- (a) list the species likely to be translocated by the different gear types and associated with fishing boats – including algae
- (b) assess the risk associated with translocation
  - (i) outline the likely implications of translocation on aquaculture, other water users and the environment
  - (ii) provide details of proposed mitigation methods including information from any available pest species threat abatement plan
  - (iii) outline a contingency plan for any pest/fouling species likely to be translocated by the fishery.

### **5. Fish Health and Disease**

Assess the potential impacts on fish health and disease from the proposed activity, in particular

- (a) assess the impacts of all gear types and fishing methods on the health of wild fish including the available knowledge on stress, injury and susceptibility to disease; outline measures to minimise impacts on the health of wild fish resources.
- (b) assess the risk to the health of wild fish from the use of imported bait to the NSW; outline measures to minimise impacts on the health of wild fish resources.
- (c) Assess the risks to the health of wild fish from any stock enhancement programs associated with the fishery; outline measures to minimise impacts on the health of wild fish resources.

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## **PHYSICAL ISSUES**

### **6. Water quality issues**

Assess the impacts on water quality and hydrological systems from the fishing and related activities, in particular:

- (a) identify potential sources of pollutants/contaminants from the fishing operations likely to affect the water quality, outline the characteristics, magnitude and probable frequency of these events, including:
  - (i) the use of substrate treatments (antifouling agents),
  - (ii) accidental or deliberate discharge of chemicals, fuels or bilge water
  - (iii) discharge/dumping of debris (plastics, gear and general waste)
  - (iv) discharge/dumping of waste from processing on board
- (b) consider the risk to water quality from potential physical and chemical changes and the general condition or characteristics of the waterbody and the likely assimilation capacity of the receiving water under normal fishing operations and when there is an incident or abnormal conditions; in particular consider potential cumulative impacts in ports or estuaries where boats are moored, cleaned or maintained or on-shore processing is undertaken,
- (c) if impacts are likely to be significant in particular areas, a baseline study of the existing water quality and flow characteristics should be outlined and monitoring data analysed to provide the basis for changes in practices in the area.

### **7. Noise and light**

Assess the impacts on the environment from noise made during the proposed fishing operation any likely affected residences and on bird colonies or aquatic species, in particular:

- (a) identify any potential fixed and mobile noise and light sources during operation of the fishing activity and proposed hours of operation.
  - (i) identify nearby land uses likely to be affected by noise/light and separation distances; estimate whether noise/light is likely to be an issue.
  - (ii) identify any bird, mammals or aquatic species whose behaviour (roosting, feeding grounds, migration routes etc) is likely to be significantly or permanently modified in response to noise or light from the fishery activities.
- (b) Outline measures to manage impacts to an acceptable level; assess the adequacy of mitigation and management measures, for instance alternative location of noise generating activities, alternative lighting design, alternative trawl routes, other management strategies to reduce impacts at sources

### **8. Air Quality**

Assess the impact of the proposed activity on air quality, in particular:

- (a) outline the likely sources of odours or other air impacts;
- (b) consider the likely impact of air emissions; if significant impacts are likely, consider the conditions under which nearby dwellings and sensitive land uses are likely to be affected.
- (c) outline measures to manage impacts to an acceptable level.

## **9. Energy and greenhouse issues**

- (a) Consider the efficiency of energy use taking into consideration issues relating to:
  - (i) boat/motor performance and energy efficiency,
  - (ii) method options and catch/effort issues.
  - (iii) potential for use of alternative power sources
- (b) Identify measures to maximise energy efficiency and minimise the emission of greenhouse gases

## **10. Potential impacts on the fishery**

- (a) Outline potential land based activities likely to affect the environment on which the fishery relies such as
  - (i) urban foreshore development including marinas, clearing of foreshore vegetation and wetlands, reclamation,
  - (ii) stormwater and sewage outfalls,
  - (iii) disturbance/drainage of acid sulphate soils,
  - (iv) pollution from point and diffuse sources,
- (b) Outline potential water based activities likely to affect the environment on which the fishery relies such as
  - (i) vessel activities – commercial shipping, other commercial fishing activities, recreational boating,
  - (ii) dredging,
  - (iii) barriers to river flow and structural engineering works, groynes, training walls
- (c) identify dredging works necessary to maintain access necessary for the fishery activities under the strategy including the cycle of dredging necessary and the risk to boats if dredging or other works not undertaken.
- (d) outline the types of management measures necessary to limit the impacts of these external factors in terms of
  - (i) landuse planning and development controls
  - (ii) measures in the fishery management strategy with regard to fishery practices.

## **11. Data requirements in relation to the assessment of the impacts on the biophysical environment**

- (a) Provide reference to technical data and other information relied upon to assess impacts; indicated its reliability and what uncertainties (if any) are associated with the use of the data in the assessment of the FMS
- (b) Identify where there are gaps in knowledge important for the assessment of the impacts of the fishery
- (c) detail a timetable for developing the data sets important for understanding longer term resource issues.

## **G. ECONOMIC ISSUES**

Assess the likely economic impacts of implementing the management strategy having regard to the following:

### **1. Review of the existing situation**

- (a) location, structure (including interrelationships), age and investment in the fishing fleet (if relevant); consider the regional or sub-regional implications
- (b) location and condition of existing infrastructure – such as transport (water and road), berthing facilities, maintenance and repairs, cold stores if relevant, distribution and/or processing facilities; consider the regional or sub-regional implications
- (c) employment by regions and sub-regions for fishers including direct employment eg boat owners, skippers and crew and indirect employment (cold stores, traders, suppliers); identify the distribution of income including seasonality factors; identify proportion of fishers with employment in other sectors as well as fishing (where possible estimate % of income non-fisheries related for boat owners, skippers and crew) or could be considered to be semi-retired;
- (d) examine current effort levels including latent effort and the link between effort and economic performance and the viability of the commercial operations
- (e) markets for fish harvested under the strategy, eg. as domestic/export market for human food, pet/aquaculture food or other uses
- (f) the economic return from the fishery including its contribution to individual, regional, state and national income; estimate the value of the share/licence held by individual fishers within the fishery
- (g) existing economic multiplier effects – costs and benefits

## **2. Likely economic implications of implementing the strategy**

- (a) outline market development/ trends likely to affect the fishery – export/domestic/ import replacement – including strengths and weaknesses, threats and opportunities
- (b) outline the implication of implementing the strategy on access rights and the impacts on economic viability; consider the impact on the value of any shares/licences as a result of changes in the fishery management associated with implementing the strategy; consider the impact on this value as a result of any closures as a result of recreational fisheries.
- (c) outline any feasible options for changes in the resource allocations within the fishery including:
  - (i) the likely economic impacts on particular sectors within the fishery if these options were implemented
  - (ii) any likely changes to the economic multiplier effects – costs and benefits
  - (iii) possible measures which could be taken to mitigate any impacts
- (d) outline any feasible options for changes in the resource allocations between fishery including between commercial fisheries and recreational fishing and non-fishing sectors including:
  - (i) the likely economic impacts on particular sectors within the fishery if these options were implemented in terms of export replacement, unemployment and retraining, alternative investment, tourism related activities
  - (ii) outline the economic implications associated with the need to upgrade any infrastructure to support existing or any changes in the fishery – such as transport (water and road), berthing facilities, maintenance and repairs, cold stores is this relevant, distribution and/or processing facilities
  - (iii) any changes to the economic multiplier effects – costs and benefits
  - (iv) possible measures which could be taken to mitigate any impacts
- (e) predict the likely economic implications of maintaining the present resource allocation rules.
  - (i) Compare these with the likely economic implications of implementing the strategy or feasible options for changes in resource allocation.
- (f) Justify the preferred approach in terms of ESD principles.

## **3. Data requirements in relation to the assessment of the impacts on the economic issues**

- (a) Provide reference to technical data and other information relied upon to assess impacts; indicated its reliability and what uncertainties (if any) are associated with the use of the data in the assessment of the FMS
- (b) Identify where there are gaps in knowledge important for the assessment of the impacts of the fishery
- (c) detail a timetable for developing the data sets important for understanding longer term resource issues.

## **H. SOCIAL ISSUES**

Assess the likely social impacts of the fishing activity proposed under the management strategy having regard to the following:

### **1. Review of the existing situation**

- (a) Describe the demographic profile of those employed in the fishery (by regions/sub-regions/fleets) – including
  - (i) direct employment eg boat owners, skippers and crew; identify those with multiple endorsements and those “part-time” fishers (eg with other sources of employment, or semi retired); and
  - (ii) indirect employment (cold stores, traders, suppliers);
- (b) Outline the community values associated with commercial fishing, in particular :
  - (i) fishers’ ways of life; fishing communities and trends associated with changes in fishing technology, communications and estuary management practices
  - (ii) social capital issues; age distribution of fishers; skill base and transferability of skills; consider trends by region or sub –region affecting entry or exiting of fishers, employees or boat owners in the sector
  - (iii) community views and perceptions
- (c) Identify current interaction of commercial fishing with the community including
  - (i) other recreational activities – fishing, boating, swimming, diving, whale/seal watching and other eco-tourism activities, discuss the potential for conflicts and synergies on a regional/subregional basis through interaction with recreational fishers, eco-tourism and related activities;
  - (ii) the visual and amenity issues

### **2. Likely social implications of implementing the strategy**

#### **2.1 Health and safety issues**

Identify health issues associated with the handling and processing of fish. This should include contingency plans for known or potential risks to product safety.

- (a) identify the any health risks associated with environment (eg algal blooms, pollution/contamination in the water/sediments, etc); identify measures for minimising the risks from these sources. eg the Biotxin Management Plans for Papis developed by NSW Fisheries and now managed by Safefood.
- (b) outline health risks associated with the handling and processing of fish and quality control measures to minimise risks from these sources. This is a Safefood NSW production requirement.

- (c) outline the health risks to fishers and related workers from current practices/methods and measures to minimise risks. This issue relates to Workcover requirements.

## **2.2 Social implication for fishers of any changes in resource allocations**

- (a) predict the likely social implications of maintaining the present resource allocation rules.
- (b) outline any implications on fishers, their families or any local communities from any changes in the resource allocations including the likely social impacts on particular sectors (eg in certain locations, sub-regions or regions) if changes in the resource allocations were implemented; outline any possible measures which could be taken to mitigate any impacts
- (c) Compare the social implications of implementing the strategy in the short, mid or longer term (if relevant, consider regional, sub-regional or fleet issues).
- (d) identify any existing or likely conflicts within or between communities
- (e) consider the affects on conflicts of any proposed changes in resource allocations
- (f) Identify the likely change in attitudes to compliance and the likely changes in the level of compliance
- (g) Justify the preferred approach in terms of ESD principles.

## **2.3 Heritage issues**

- (a) Identify shipwreck sites or other sites of historic heritage that are likely to be affected by fishing activities and outline measures to minimise risk of harm to these sites.
- (b) Identify any important Aboriginal heritage sites/places used by fishers and outline protocols/measures to be developed in consultation with representatives of the Aboriginal community to minimise risk of harm to these sites.

## **3. Indigenous issues**

- (a) Identify the interests of Indigenous people in the resources harvested by the fishery and in habitats that may be impacted by the proposed activity.
- (b) Assess the impacts of the activities proposed to be authorised by the management strategy on Indigenous interests. In particular, assess the impacts of implementing the strategy on:
  - (i) traditional fishing, including access, participation and culture (such as places of significance – middens, totemic symbols etc.),
  - (ii) Indigenous communities' well being, including economics, employment and community viability,
  - (iii) Government policies on Indigenous fisheries issues, including the NSW Indigenous Fisheries Strategy.
- (c) Mitigation and management measures



#### **4. Data requirements in relation to the assessment of the impacts on the social issues**

- (a) Provide reference to technical data and other information relied upon to assess impacts; indicated its reliability and what uncertainties (if any) are associated with the use of the data in the assessment of the FMS
- (b) Identify where there are gaps in knowledge important for the assessment of the impacts of the fishery
- (c) detail a timetable for developing the data sets important for understanding longer term resource issues.

#### **I. JUSTIFICATION FOR PROPOSED COMMERCIAL FISHING ACTIVITY**

- (a) Outline the need for undertaking the fishing activities as proposed under the FMS including the consequences of not undertaking the activity.
- (b) Undertake a sensitivity analysis in relation to biophysical, social and economic costs and benefits of implementing the proposed regulatory and management measures in the FMS
  - (i) alternative harvest strategies (ie. different management options, such as input vs output controls)
  - (ii) alternative resource allocation mixes within the fishery
  - (iii) alternative resource allocation mixes
    - between commercial fisheries,
    - between commercial fisheries, recreational fisheries, indigenous fisheries and conservation
  - (iv) alternative resource allocation on a regional basis, consider the resource allocation mix within a region as well as between the regions
- (c) Within the constraints of the carrying capacity of the aquatic environment, justify in terms of the principles of ESD the selection of:
  - (i) the preferred resource allocation mix; and
  - (ii) the preferred suite of “rules” in the strategy.

**APPENDIX 1**

| <b>Act</b>                                                                         | <b>Relevant Authority</b>                                               | <b>Regulatory provisions</b>                                                                                                                                                                              |
|------------------------------------------------------------------------------------|-------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>NSW Legislation</b>                                                             |                                                                         |                                                                                                                                                                                                           |
| Fishery Management Act 1994                                                        | NSW Fisheries                                                           | Fishing authorisations, fishing closures, declaration and management of aquatic reserves, protection of certain fish including threatened and protected species.                                          |
| Environmental Planning and Assessment Act 1979                                     | Department of Urban Affairs and Planning (DUAP) and Local Councils      | Administration of the environmental impact assessment and project approval system. Development of environmental planning instruments which may protect wetlands or certain other areas.                   |
| Marine Parks Act 1997                                                              | Marine Parks Authority                                                  | Declaration and management of marine parks                                                                                                                                                                |
| National Parks and Wildlife Act 1974 and Threatened Species Conservation Act 1995  | National Parks and Wildlife Service                                     | Declaration and management of nature reserves and national parks, protection of certain mammals, birds and foreshore species including threatened and protected species                                   |
| Port Corporation and Waterways Management Act 1995                                 | Waterways Authority or relevant Port Corporation                        | Use of ports, wharfs, berths, moorings etc, licensing of vessels and maintenance of safe navigation in waterways                                                                                          |
| Crown Lands Act 1989 and Rivers and Water Act 2000/ Foreshores Protection Act 1948 | Department of Land and Water Conservation                               | Use of Crown land for wharfs, berths or moorings and protection of river, estuary and coastal foreshores.                                                                                                 |
| Food Production (safety) Act 1998                                                  | SafeFood                                                                | Fish products safe for human consumption                                                                                                                                                                  |
| <b>Commonwealth Legislation</b>                                                    |                                                                         |                                                                                                                                                                                                           |
| Wildlife Protection (Regulation of Export and Imports) Act 1982                    | Agriculture, Forestry and Fisheries Australia and Environment Australia | Licence to export protected wildlife                                                                                                                                                                      |
| Environment Protection and Biodiversity Conservation (EPBC) Act 1999               | Environment Australia                                                   | Environmental Assessment of matters of National Significance including those affecting protected or threatened species, Ramsar wetlands, bird and mammal species protected under international agreements |

## GLOSSARY

|                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
|-------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Associated and/or dependent species       | species associated with or dependent upon harvested species, for example species which are predator or prey of the harvested species.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Biological diversity, biodiversity        | the variability among living organisms from all sources (including marine and other aquatic ecosystems and the ecological complexes of which they are part). Includes 1) diversity within species and between species; and 2) diversity of ecosystems.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             |
| Bycatch                                   | species that are discarded from the catch or retained for scientific purposes, and that part of the “catch” that is not landed but is killed as a result of interaction with fishing gear. This includes discards of commercially valuable species.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| By-product                                | Are not target species but are species that are retained because they are commercially valuable                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Designated fishing activities             | <p>As defined in the Fishery Management Act, are:</p> <ul style="list-style-type: none"> <li>• Category 1 Share Management Fisheries including abalone fishery and the lobster fishery</li> <li>• Category 2 Share Management Fisheries including ocean prawn trawl fishery, ocean fish trawl fishery, ocean hauling fishery, ocean trap and line fishery, the estuary general fishery and the estuary prawn trawl fishery.</li> <li>• Charter boat fisheries</li> <li>• Recreational fisheries</li> <li>• Fish stocking</li> <li>• Shark meshing, and</li> <li>• Other fishing activities proclaimed by the Governor on the recommendation of the Minister for Fisheries to be designated fishing activities.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
| Discards                                  | Are those components of a fish stock thrown back after capture. Normally, most of the discards can be assumed not to survive                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
| Ecologically sustainable development, ESD | <p>Ecologically sustainable development, ESD, is using, conserving and enhancing the community’s resources so that the ecological processes, on which life depends, are maintained and the total quality of life now and in the future, can be increased (National Strategy for ESD, Council of Australian Governments 1992).</p> <p>Ecologically sustainable use of natural resources means the use of components of biological diversity in a way and at a rate that does not lead to the long term decline of biological diversity and to sustain natural processes within their capacity while maintaining the life-support systems of nature thereby maintaining their potential to meet the needs and aspirations of future generations.</p> <p>A sustainable fishery is consistent with ESD if that fishery conserves and enhances the community’s resources so that the ecological processes, on which life depends, are maintained and the total quality of life now and in the future, can be increased</p> <p>Principles of Ecologically Sustainable Development (Intergovernmental Agreement on the Environment)</p> <ol style="list-style-type: none"> <li>1 The precautionary principle— Where there are threats of serious or irreversible environmental damage, lack of full scientific certainty should not be used as a reason for postponing measures to prevent environmental degradation.<br/>In the application of the precautionary principle, public and private decisions should be guided by:</li> </ol> |

- (a) careful evaluation to avoid, wherever practicable, serious or irreversible damage to the environment, and
- (b) an assessment of the risk-weighted consequences of various options.
- 2 Intergenerational equity— the present generation should ensure that the health, diversity and productivity of the environment is maintained or enhanced for the benefit of future generations
- 3 Conservation of biological diversity and ecological integrity— conservation of biological diversity and ecological integrity should be a fundamental consideration.
- 4 Improved valuation, pricing and incentive mechanisms—
  - (a) environmental factors should be included in the valuation of assets and services,
  - (b) polluter pays— those who generate pollution and waste should bear the cost of containment, avoidance or abatement,
  - (c) the users of goods and services should pay prices based on the full life cycle of costs of providing goods and services, including the use of natural resources and assets and the ultimate disposal of any waste,
  - (d) environmental goals, having been established, should be pursued in the most cost effective way, by establishing incentive structures, including market mechanisms, that enable those best placed to maximise benefits or minimise costs to develop their own solutions and responses to environmental problems.

|                                     |                                                                                                                                                                                                                                                                                                                                                                                      |
|-------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Ecologically related species        | species which, while not associated with or dependent upon a harvested species, nevertheless are affected by the fishing operation.                                                                                                                                                                                                                                                  |
| Ecologically viable stock           | ecological viable stock has a general rather than a specific meaning. It refers to the maintenance of the exploited population at high levels of abundance designed to maintain productivity, provide margins of safety for error and uncertainty and maintain yields over the long term in a way that conserves the stocks role and function in the ecosystem.                      |
| Ecosystem                           | the biotic (living) community and its abiotic (non-living) environment.                                                                                                                                                                                                                                                                                                              |
| Fish                                | Fish are marine, estuarine or freshwater fish or other aquatic animal life at any stage of their life history (whether alive or dead) and include oysters and other aquatic molluscs, crustaceans, endinoderms, and beach works and other aquatic polychaetes. Fish does not include whales, mammals, reptiles, birds or amphibians.                                                 |
| Fish stock/resources                | Means the living resources in the community or population from which catches are taken in a fishery. Fish stock may include one or several species of fish but may also include commercial invertebrates and plants. Recruits to a stock are the young fish entering the exploited component of the stock for the first time.                                                        |
| Fishery                             | A unit determined by an authority or other entity that is engaged in raising and /or harvesting fish. Under the Fisheries Management Act 1994, fishery is a class of fishing activity identified by reference to any one or more of the following: species or class of fish, area of water or seabed, method of fishing, class of boats, class of persons and purpose of activities. |
| Management Advisory Committee (MAC) | MACs have been established for each share management or restricted fishery. Members are elected by the commercial fishers of the fishery or appointed by the Minister. The MAC advises the Minister on the fishery matters including the preparation of regulations or management strategy, monitors their implementation and assists in reviewing the regulations or strategy.      |

|                                                           |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|-----------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Fishing activity                                          | Fishing activity is the activity of taking fish and includes: searching for fish, any activity likely to result in locating, aggregating or taking of fish or carrying fish by boat from the places where they are taken to the place where they are to be landed.                                                                                                                                                                                                                                                                                                                                                        |
| Fishing effort                                            | Represents the amount of fishing gear of the specific type used on the fishing grounds over a given unit of time eg hours trawled per day, number of hooks set per day or number of hauls of a beach seine per day                                                                                                                                                                                                                                                                                                                                                                                                        |
| FRCAC                                                     | The Fisheries Resource Conservation and Assessment Council is a statutory body appointed by the Minister for Fisheries that will advise on the preparation, review and assessment of fishery management strategies.                                                                                                                                                                                                                                                                                                                                                                                                       |
| Management regime                                         | In this document, refers to the policies, plans, action plans, strategic research plans, and all documentation that relates to the operations and management of the fishery.                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| Ministerial Advisory Council                              | Ministerial Advisory Councils for commercial, recreational, research and aquaculture sectors are appointed by the Minister to advise him on any matter relating to the sector for which the council has been established.                                                                                                                                                                                                                                                                                                                                                                                                 |
| Overfishing                                               | <p>can be defined in two ways which can act independently or concurrently:</p> <p>“recruitment overfishing”, where fishing activities are causing a reduction in recruitment in succeeding years and cause the mortality of too many fish in total, too many pre-productive fish, or too many fish that have only spawned a few times. The end result is that the stock can no longer replenish itself adequately.</p> <p>“growth overfishing”: where fishing activities lead to a reduction in the size of the individuals of a species, as a consequence of which few specimens grow to the size for optimum yield.</p> |
| Precautionary recovery strategy                           | management and operational strategy, designed to increase numbers within the stock, that incorporates the precautionary approach and includes mechanisms to avoid or mitigate adverse ecosystem effects.                                                                                                                                                                                                                                                                                                                                                                                                                  |
| Protected species                                         | are species protected under the NSW legislation (FM Act or NPW Act) or Commonwealth legislation (Wildlife Protection (Regulation of Export and Imports) Act or Environment Protection and Biodiversity Conservation (EPBC) Act)                                                                                                                                                                                                                                                                                                                                                                                           |
| Productivity                                              | when applied to fish stocks the term productivity gives an indication of the birth, growth and death rates of a stock.                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| Stock                                                     | In the strict sense, a distinct, reproductively isolated population. In practice, a group of individuals of a species in a defined spatial range that is regarded as having a relatively low rate of exchange with others of the species.                                                                                                                                                                                                                                                                                                                                                                                 |
| Threatened species, populations or ecological communities | Are listed as vulnerable, endangered or presumed extinct under the FM Act 1993 or Threatened Species Conservation Act 1995 or Environment Protection and Biodiversity Conservation (EPBC) Act).                                                                                                                                                                                                                                                                                                                                                                                                                           |

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## A3. PLANNING NSW GUIDELINES/EIS CHECKLIST

| Section    | DUAP Guideline                                    | EPT Sections                           | Guideline Addressed? | Comment                                               |
|------------|---------------------------------------------------|----------------------------------------|----------------------|-------------------------------------------------------|
| <b>A</b>   | <b>EXECUTIVE SUMMARY</b>                          |                                        | Yes                  |                                                       |
| <b>B</b>   | <b>REVIEW OF EXISTING OPERATION OF FISHERY</b>    |                                        |                      |                                                       |
| <b>1</b>   | Fish stock                                        |                                        |                      |                                                       |
|            | a Identify harvested stocks                       | B1c, B2a, B7a(i)-e(i)                  | yes                  |                                                       |
|            | b Status of fish stock                            | B4a                                    | yes                  |                                                       |
|            | c Interactions with other fisheries               | B6a                                    | Yes                  |                                                       |
| <b>2</b>   | Existing operational area/regions                 | B7, B1, C6c,g                          | Yes                  |                                                       |
|            | a Fishing areas                                   | B1c, B7                                | yes                  |                                                       |
|            | b Operational areas                               | B3a, B1c, B7, C6c,g                    | yes                  |                                                       |
|            | c Jurisdictional issues                           | B1a                                    | yes                  |                                                       |
|            | d Important habitats                              | B6c                                    | yes                  |                                                       |
|            | e Fished habitats                                 | F1a                                    | yes                  |                                                       |
| <b>3</b>   | Current fisher and harvest information            | B3b, B5b(iii), B7a-e                   | yes                  |                                                       |
|            | a Fishers and endorsements                        | B5b(i-vi), C6b,g                       | yes                  |                                                       |
|            | b Total employment                                | G                                      | yes                  |                                                       |
|            | c Fishing gear and boats                          | B3b(i-ii,iv); B5b(iii,vii); C6d, B7a-e | yes                  |                                                       |
|            | d Catch, value and effort trends                  | B4b, B5e, B7a(ii)-e(ii)                | yes                  |                                                       |
| <b>4</b>   | Current regulatory and management measures        | B5b(v), B5a                            | yes                  |                                                       |
|            | a Management tools                                | B5b                                    | yes                  |                                                       |
|            | b Existing management plans                       | B7a(iii)-e(iii)                        | yes                  |                                                       |
|            | c Strengths and weaknesses                        | B8                                     | yes                  |                                                       |
|            | d Administrative arrangements                     | B5c-e                                  | yes                  |                                                       |
| <b>5</b>   | Factors outside the fishery affecting the fishery |                                        |                      |                                                       |
|            | a Other NSW fisheries                             | B6a(i-iii), B6d(i-vii)                 | yes                  |                                                       |
|            | b Commonwealth or other state fisheries           |                                        | Not applicable       |                                                       |
|            | c Environmental factors                           | B6b, B6c(i-v), B8a(i-ix)               | yes                  |                                                       |
| <b>C</b>   | <b>DRAFT COMMERCIAL FMS</b>                       |                                        |                      |                                                       |
| <b>1</b>   | Objectives                                        | C4a-b                                  | yes                  |                                                       |
| <b>2</b>   | Designated fishing activity                       | C1a, C1b(i), C6b                       | yes                  |                                                       |
| <b>2.1</b> | Affected fish stock                               |                                        |                      |                                                       |
|            | a Identify species                                | C6e, App. B                            | yes                  |                                                       |
|            | b Target species of other fisheries               | E1, App. B                             | yes                  |                                                       |
|            | c Estimate future harvest levels                  | C5                                     | partial              | Acceptable estimates presented through trigger points |
| <b>2.2</b> | Operational areas of FMS                          | C6c                                    |                      |                                                       |
|            | a Principal areas                                 | C6c, C6g(i-v)                          | yes                  |                                                       |
|            | b Operational areas                               | C6g(i-v)                               | yes                  |                                                       |
|            | c Jurisdictional issues                           | C1c(i), B1a, B1c                       | yes                  |                                                       |
|            | d Restricted areas                                | C1c(ii-iv)                             | yes                  |                                                       |
|            | e Important habitats                              | C3a, g                                 | yes                  |                                                       |
| <b>2.3</b> | Resource allocation under the                     | C6g(i-v), C4, C6g,l                    | yes                  |                                                       |
|            | a Harvest strategy                                | C3d, C6                                | yes                  |                                                       |
|            | b Entitlements and shares                         | C1d, C6a(i), C6h(iii), C6m, C3f        | yes                  |                                                       |

| Section  | DUAP Guideline                                                       | EPT Sections                                 | Guideline Addressed? | Comment                                             |
|----------|----------------------------------------------------------------------|----------------------------------------------|----------------------|-----------------------------------------------------|
| <b>C</b> | <b>DRAFT COMMERCIAL FMS</b>                                          |                                              |                      |                                                     |
| <b>3</b> | Interaction between fisheries                                        |                                              |                      |                                                     |
|          | a Common factors between                                             | B6a                                          | yes                  |                                                     |
|          | b Conflict                                                           | B8, C4, C3h                                  | yes                  |                                                     |
|          | c Improving arrangements between fisheries                           | C3f, C4                                      | yes                  |                                                     |
|          | d Improving arrangements between fisheries and non-consumptive users | C4, C3h, B8                                  | yes                  | In particular, goal 4 in C4                         |
| <b>4</b> | Regulatory controls and management measures                          | C6a(ii),d,h,f, C6g-h                         | yes                  |                                                     |
|          | a Stocks                                                             | C6e(ii), C6g(i-v), C4, C6e(i), C6e(iii), C6g | yes                  |                                                     |
|          | b Harvesting strategy                                                | C6, C6g(i-v), C6g, C3b                       | yes                  |                                                     |
|          | c Contingency measures                                               | C6g(i-v), C5d                                | yes                  |                                                     |
|          | d Administrative mechanisms                                          | C4, C6g(i-v), C6i(i-iii), C6k                | yes                  |                                                     |
|          | e Fisher improvements                                                | C4                                           | yes                  | In particular, goals 1, 3 & 8 in C4                 |
| <b>5</b> | Monitoring and responsive management                                 |                                              |                      |                                                     |
|          | a Performance indicators                                             | C5a(i), C5e,f                                | yes                  |                                                     |
|          | b Triggers for contingency action                                    | C5a(ii),e-f; C5h                             | yes                  |                                                     |
|          | c Monitoring programs                                                | C5(i)                                        | yes                  |                                                     |
| <b>6</b> | Proposed research programs                                           | C3(i)                                        | yes                  |                                                     |
|          | a Research needs                                                     | C6j(i-vi)                                    | yes                  |                                                     |
|          | b Short and long-term objectives                                     | C6j(i-vi), C4a-b                             | yes                  |                                                     |
|          | c Links with monitoring management programs                          | C6ji-vi, C4, C5ci-iii; C5i                   | yes                  |                                                     |
| <b>D</b> | <b>ALTERNATIVE MANAGEMENT REGIMES</b>                                |                                              |                      |                                                     |
| <b>1</b> | Feasible alternatives                                                |                                              |                      |                                                     |
|          | a Fishery characterisation                                           | D1a                                          | yes                  |                                                     |
|          | b Fisher/share numbers and regimes                                   | B5b(i-iv)                                    | partial              | Only to a point that is considered feasible         |
|          | c Objectives                                                         | D1a                                          | partial              | Discussion is presented on why this is not feasible |
|          | d Management measures                                                | D1a                                          | yes                  |                                                     |
|          | e Performance indicators and triggers                                | D1a                                          | partial              | Discussion is presented on why this is not feasible |
|          | f Monitoring regimes                                                 | D1c                                          | yes                  |                                                     |
|          | g Research programs                                                  | D1c                                          | yes                  |                                                     |
| <b>2</b> | Effectiveness of alternatives                                        |                                              |                      |                                                     |
|          | a Viable stock levels                                                | D1c                                          | yes                  |                                                     |
|          | b Rebuild overfished stocks                                          | C4                                           | yes                  | In particular, goal 2 in C4                         |
|          | c Conservation of ecosystem                                          | C4, D1c(i-iii,v,vii-viii)                    | yes                  | In particular, goal 1 in C4                         |
|          | d Key habitat protection                                             | D1b(ii)                                      | yes                  |                                                     |
|          | e Threat to bycatch species                                          | D1b(viii)                                    | yes                  |                                                     |
|          | f Responsible stewardship                                            | D1c(iii)                                     | yes                  |                                                     |
| <b>3</b> | Justify preferred FMS options                                        | D3                                           |                      |                                                     |



| Section  |          | DUAP Guideline                                                | EPT Sections       | Guideline Addressed? | Comment                                                 |
|----------|----------|---------------------------------------------------------------|--------------------|----------------------|---------------------------------------------------------|
| <b>E</b> |          | <b>IMPACT ON FISH RESOURCES</b>                               |                    |                      |                                                         |
|          | <b>1</b> | Retained Species                                              |                    |                      |                                                         |
|          | a        | Status of target and non-target species                       | E1a(i-ii)          | Partial              | Provided for the 2 target species & 1 byproduct species |
|          | b        | Species stock assessment                                      | E1a(i-ii), App. E1 | Partial              | Provided for the 2 target species & 1 byproduct species |
|          | c        | Resource status and sustainability                            | E1a-b              | yes                  |                                                         |
|          | d        | Allocation of resources                                       | B3, B5, C3, D      | Partial              | Detailed alternatives not assessed                      |
|          | e        | Adequacy of stock management/recovery programs                | E1b(i)             | yes                  |                                                         |
|          | f        | Management of target and by-product species                   | E1b                | yes                  |                                                         |
|          | g        | Precautionary management measures                             | E1b                | yes                  |                                                         |
|          | h        | Confidence in predicted                                       | E1b                | yes                  |                                                         |
|          | i        | Adequacy of proposed monitoring program                       | E4b                | yes                  |                                                         |
|          | j        | Adequacy of research proposals                                | E4a(ii)            | yes                  |                                                         |
|          | k        | Acceptability of proposed sustainability measures             | E4, E1a-b          | yes                  |                                                         |
|          | <b>2</b> | Bycatch species                                               |                    |                      |                                                         |
|          | a        | Impact on bycatch species                                     | E2a                | yes                  |                                                         |
|          | b        | Alternatives to reduce bycatch                                | E2a                | yes                  |                                                         |
|          | c        | Adequacy of bycatch management/recovery programs              | E2b-d              | yes                  |                                                         |
|          | d        | Uncertainty of management of bycatch and non-retained species | E2c                | yes                  |                                                         |
|          | e        | Precautionary management measures                             | E2c                | yes                  |                                                         |
|          | f        | Confidence in predicted                                       | E2c                | yes                  |                                                         |
|          | g        | Reduction of adverse environmental impacts                    | E2c                | yes                  |                                                         |
|          | <b>3</b> | Bait resources                                                |                    |                      |                                                         |
|          | a        | Source, species and volume of bait                            | E3                 | Not applicable       | No bait used in the fishery                             |
|          | b        | Alternatives to reduce impacts                                | E3                 | Not applicable       | No bait used in the fishery                             |
|          | <b>4</b> | Data requirements for assessment                              | E4b(i-ii), E4c     | Yes                  |                                                         |
|          | a        | Reliability of technical data                                 | E4a                | yes                  |                                                         |
|          | b        | Gaps in knowledge                                             | E4a(i-ii)          | yes                  |                                                         |
|          | c        | Research timeframes                                           | E4d                | partial              | Few details provided                                    |

| Section  |          | DUAP Guideline                                         | EPT Sections             | Guideline Addressed? | Comment                                                                               |
|----------|----------|--------------------------------------------------------|--------------------------|----------------------|---------------------------------------------------------------------------------------|
| <b>F</b> |          | <b>IMPACT ON THE BIOPHYSICAL ENVIRONMENT</b>           |                          |                      |                                                                                       |
|          | <b>1</b> | Biodiversity and habitat                               |                          |                      |                                                                                       |
|          | a        | Key habitat areas                                      | F1a(i-v), F1b, App. F1-3 | Yes                  |                                                                                       |
|          | b        | Habitat disturbance                                    | F1c                      | yes                  |                                                                                       |
|          | c        | Impact of fishing                                      | F1c(i-v)                 | Partial              | No data specific to fishery or methods - extrapolations from studies of other methods |
|          | d        | Uncertainty associated with management                 | F1e                      | yes                  |                                                                                       |
|          | e        | Precautionary management measures                      | F1d                      | yes                  |                                                                                       |
|          | f        | Confidence in predicted                                | F1e                      | yes                  |                                                                                       |
|          | g        | Alternate management measures                          | F1f                      | yes                  |                                                                                       |
|          | h        | Gaps in knowledge                                      | F11a(i)                  | yes                  |                                                                                       |
|          | <b>2</b> | Threatened and protected species                       |                          |                      |                                                                                       |
|          | a        | Identify species and habitats                          | F2a, App. F4             | yes                  |                                                                                       |
|          | b        | Impact of fishing                                      | F2b                      | yes                  |                                                                                       |
|          | c        | The eight-part test                                    | F2c                      | yes                  |                                                                                       |
|          | d        | Uncertainty associated with management                 | F2d(i)                   | yes                  |                                                                                       |
|          | e        | Precautionary management measures                      | F2e                      | yes                  |                                                                                       |
|          | f        | Confidence in predicted                                | F2d(iii), F2e            | yes                  |                                                                                       |
|          | g        | Effectiveness of mitigation measures                   | F2d(iv), F2e             | yes                  |                                                                                       |
|          | <b>3</b> | Trophic structure                                      |                          |                      |                                                                                       |
|          | a        | Identify species likely to be affected                 | F3a                      | yes                  |                                                                                       |
|          | b        | Productivity flows                                     | F3b                      | yes                  |                                                                                       |
|          | c        | Provision of food                                      | F3b                      | yes                  |                                                                                       |
|          | d        | Effectiveness of mitigation measures                   | F3c                      | yes                  |                                                                                       |
|          | <b>4</b> | Translocation and stock enhancement                    |                          |                      |                                                                                       |
|          | a        | Species likely to be translocated                      | F4b                      | yes                  |                                                                                       |
|          | b        | Associated risk and contingency plan                   | F4a, F4c-f               | yes                  |                                                                                       |
|          | <b>5</b> | Fish Health and Disease                                |                          |                      |                                                                                       |
|          | a        | Impacts of gear type and fishing methods               | F5a                      | partial              | Little information                                                                    |
|          | b        | Risk from imported bait                                | F5b                      | Not applicable       |                                                                                       |
|          | c        | Stock enhancement risks                                | F5c                      | yes                  |                                                                                       |
|          | <b>6</b> | Water quality issues                                   |                          |                      |                                                                                       |
|          | a        | Pollutants/contaminants from fishing operations        | F6a(i-iv)                | yes                  |                                                                                       |
|          | b        | Risk to water quality under normal/abnormal conditions | F6b                      | yes                  |                                                                                       |
|          | c        | Baseline study                                         | F6c                      | yes                  | Not required                                                                          |
|          | <b>7</b> | Noise and light                                        |                          |                      |                                                                                       |
|          | a        | Affect of noise/light on land uses and species         | F7a-f, App. CF1          | yes                  |                                                                                       |
|          | b        | Adequacy of management measures                        | F7a-f, App. CF1          | yes                  |                                                                                       |

| Section  |           | DUAP Guideline                                          | EPT Sections             | Guideline Addressed? | Comment |
|----------|-----------|---------------------------------------------------------|--------------------------|----------------------|---------|
| <b>F</b> |           | <b>IMPACT ON THE BIOPHYSICAL ENVIRONMENT</b>            |                          |                      |         |
|          | <b>8</b>  | Air quality                                             |                          |                      |         |
|          | a         | Sources of air impacts                                  | F8, App. CF1             | yes                  |         |
|          | b         | Impact of air emissions                                 | F8, App. CF1             | yes                  |         |
|          | c         | Acceptable management                                   | F8, App. CF1             | yes                  |         |
|          | <b>9</b>  | Energy and greenhouse issues                            |                          |                      |         |
|          | a         | Energy efficiency issues                                | F9a-b, App. CF1          | yes                  |         |
|          | b         | Measures to minimise greenhouse gas emissions           | F9a, F9b(i-ii); App. CF1 | yes                  |         |
|          | <b>10</b> | Potential impacts on the fishery                        |                          |                      |         |
|          | a         | Land based activities                                   | F10a(i-iv)               | yes                  |         |
|          | b         | Water based activities                                  | F10b(i-iv)               | yes                  |         |
|          | c         | Necessary dredging works                                | F10c                     | yes                  |         |
|          | d         | Necessary management measures                           | F10d(i-ii)               | yes                  |         |
|          | <b>11</b> | Data requirements for assessment                        |                          |                      |         |
|          | a         | Reliability of technical data                           | F11a                     | yes                  |         |
|          | b         | Gaps in knowledge                                       | F11a                     | yes                  |         |
|          | c         | Research timeframes                                     | F11a                     | yes                  |         |
| <b>G</b> |           | <b>ECONOMIC ISSUES</b>                                  |                          |                      |         |
|          | <b>1</b>  | Existing situation                                      |                          |                      |         |
|          | a         | Fishing fleet                                           | G1, App CG1              | yes                  |         |
|          | b         | Infrastructure                                          | G1, App CG1              | yes                  |         |
|          | c         | Employment and income                                   | G1, App CG1              | yes                  |         |
|          | d         | Effort levels                                           | G1, App CG1              | yes                  |         |
|          | e         | Markets                                                 | G1, App CG1              | yes                  |         |
|          | f         | Economic return                                         | G1, App CG1              | yes                  |         |
|          | g         | Costs and benefits                                      | G1, App CG1              | yes                  |         |
|          | <b>2</b>  | Likely economic implications                            |                          |                      |         |
|          | a         | Market trends                                           | G2, App. CG1             | yes                  |         |
|          | b         | Economic viability                                      | G2, App. CG1             | yes                  |         |
|          | c         | Resource allocation options within the fishery          | G2, App. CG1             | yes                  |         |
|          | d         | Resource allocation options between fisheries           | G2, App. CG1             | yes                  |         |
|          | e         | Implications of maintaining present resource allocation | G2, App. CG1             | yes                  |         |
|          | f         | Justification of preferred                              | G3                       | yes                  |         |
|          | <b>3</b>  | Data requirements for assessment                        |                          |                      |         |
|          | a         | Reliability of technical data                           | G4a                      | yes                  |         |
|          | b         | Gaps in knowledge                                       | G4b                      | yes                  |         |
|          | c         | Research timeframes                                     | G4c                      | yes                  |         |

| Section  |            | DUAP Guideline                                          | EPT Sections    | Guideline Addressed? | Comment |
|----------|------------|---------------------------------------------------------|-----------------|----------------------|---------|
| <b>H</b> |            | <b>SOCIAL ISSUES</b>                                    |                 |                      |         |
|          | <b>1</b>   | Existing situation                                      |                 |                      |         |
|          | a          | Demographic profile of                                  | H1, App. CH1    | yes                  |         |
|          | b          | Community values                                        | H1, App. CH1    | yes                  |         |
|          | c          | Interaction between commercial fishing and community    | H1, App. CH1    | yes                  |         |
|          | <b>2</b>   | Likely social implications                              | H2              |                      |         |
|          | <b>2.1</b> | Health and safety                                       | H4              |                      |         |
|          | a          | Environmental health risks                              |                 | yes                  |         |
|          | b          | Quality control measures                                | H4a(i)          | yes                  |         |
|          | c          | Health risks to fishers                                 | H4a(ii)         | yes                  |         |
|          | <b>2.2</b> | Changes in resource allocation                          |                 |                      |         |
|          | a          | Implications of maintaining present resource allocation | App. CH1        | yes                  |         |
|          | b          | Implications of any changes on local community          | App. CH1        | yes                  |         |
|          | c          | Existing or likely conflicts                            | App. CH1        | yes                  |         |
|          | d          | Compliance                                              | App. CH1        | yes                  |         |
|          | e          | Justification of preferred                              | H3              | yes                  |         |
|          | <b>2.3</b> | Heritage issues                                         | H5              |                      |         |
|          | a          | Historic sites                                          | H5a(i)          | yes                  |         |
|          | b          | Aboriginal sites                                        | H5b(i-ii)       | yes                  |         |
|          | <b>3</b>   | Indigenous issues                                       | H6, App. CH2    | yes                  |         |
|          | a          | Interests in harvested resources and habitats           | H6a-b, App. CH2 | yes                  |         |
|          | b          | Impacts on Indigenous interests                         | H6a             | yes                  |         |
|          | c          | Mitigation and management measures                      | H6b(i-ii)       | yes                  |         |
|          | <b>4</b>   | Data requirements for assessment                        |                 |                      |         |
|          | a          | Reliability of technical data                           | H7a             | yes                  |         |
|          | b          | Gaps in knowledge                                       | H7b             | yes                  |         |
|          | c          | Research timeframes                                     | H7c             | yes                  |         |
| <b>I</b> |            | <b>JUSTIFICATION FOR PROPOSED FISHING ACTIVITY</b>      |                 |                      |         |
|          | a          | Need for proposed activities                            | I1              | yes                  |         |
|          | b          | Sensitivity analysis                                    | I2              | yes                  |         |
|          | c          | Preferences in terms of ESD principles                  | I3              | yes                  |         |

## **APPENDIX B**



## APPENDIX B1. INCIDENTAL SPECIES OF THE ESTUARY PRAWN TRAWL FISHERY

The following tables (AB1, AB2, AB4, AB5, AB6 and AB7) list the species recorded by Kennelly (1993) during observer based surveys of the catches of the estuary prawn trawl fleets between 1989 and 1992. Table AB3 lists the species recorded by Ruello (1971) in a fishery independent survey using prawn trawl nets of the Hunter River. The family, scientific and common name for each species are given. Those species of commercial significance taken in other NSW commercial fisheries are marked with an "X".

**Table AB1.** List of incidental taxa caught during observer based surveys of the Estuary Prawn Trawl Fleet in the Clarence River<sup>3</sup>.

| Family                     | Scientific name                   | Common name              | Commercial |
|----------------------------|-----------------------------------|--------------------------|------------|
| <b>Finfishes:</b>          |                                   |                          |            |
| AMBASSIDAE                 | <i>Ambassis jacksoniensis</i>     | Port jackson perchlet    | -          |
| AMBASSIDAE                 | <i>Ambassis marianus</i>          | Ramseys perchlet         | -          |
| ANGUILLIDAE                | <i>Anguilla australis</i>         | Short finned eel         | -          |
| ANGUILLIDAE                | <i>Anguilla reinhardtii</i>       | Long finned eel          | -          |
| APOGONIDAE                 | <i>Siphamia roseigaster</i>       | Pink breasted siphonfish | -          |
| ARIIDAE                    | <i>Arius graeffei</i>             | Fork tailed catfish      | x          |
| BOTHIDAE                   | <i>Pseudorhombus arsius</i>       | Large toothed flounder   | x          |
| BOTHIDAE                   | <i>Pseudorhombus jenynsii</i>     | Small toothed flounder   | x          |
| CALLIONYMIDAE              | (unid. stinkfish)                 | Stinkfish                | -          |
| CARANGIDAE                 | <i>Gnathanodon speciosus</i>      | Golden trevally          | x          |
| CARCHARINIDAE              | <i>Carcharhinus</i> spp.          | Whaler shark             | x          |
| CLUPEIDAE                  | (unid. herring)                   | Unid. herring            | -          |
| CLUPEIDAE                  | <i>Herklotsichthys castelnaui</i> | Southern herring         | -          |
| CLUPEIDAE                  | <i>Hyperlophus vittatus</i>       | Sandy sprat              | -          |
| CLUPEIDAE                  | <i>Potamalosa richmondia</i>      | Freshwater herring       | -          |
| DASYATIDIDAE / UROLOPHIDAE | Stingray/stingaree                | Stingray/stingaree       | -          |
| DIDONTIDAE                 | <i>Dicotylichthys punctulatus</i> | Porcupine fish           | -          |
| DINOLESTIDAE               | <i>Dinolestes lewini</i>          | Long-finned pike         | -          |
| ELEOTRIDAE                 | (unid. gudgeon)                   | Unid. gudgeon            | -          |
| ELEOTRIDAE                 | <i>Gobiomorphus australis</i>     | Striped gudgeon          | -          |
| ELEOTRIDAE                 | <i>Hypseleotris compressus</i>    | Empire gudgeon           | -          |
| ELEOTRIDAE                 | <i>Philypnodon grandiceps</i>     | Large-headed gudgeon     | -          |
| EPHIPPIDAE                 | <i>Platax tiera</i>               | Round faced batfish      | -          |
| EXOCEOTIDAE                | <i>Arrhamphus sclerolepis</i>     | Snub-nosed garfish       | -          |
| GERREIDAE                  | <i>Gerres subfasciatus</i>        | Common silver biddy      | -          |
| GIRELLIDAE                 | <i>Girella tricuspidata</i>       | Blackfish                | x          |
| GOBIIDAE                   | (unid. goby)                      | Unid. goby               | -          |
| GOBIIDAE                   | <i>Arenigobius bifrenatus</i>     | Bridled goby             | -          |
| GOBIIDAE                   | <i>Arenigobius frenatus</i>       | Half bridled goby        | -          |
| GOBIIDAE                   | <i>Brachyambloypus coecus</i>     | Blind goby               | -          |
| GOBIIDAE                   | <i>Favonigobius tamarensis</i>    | Tamar river goby         | -          |
| GOBIIDAE                   | <i>Redigobius macrostoma</i>      | Large mouth goby         | -          |
| GOBIIDAE                   | <i>Valenciennesa longipinnis</i>  | Striped goby             | -          |

<sup>3</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB1 (cont)<sup>4</sup>.

| Family              | Scientific name                 | Common name                 | Commercial |
|---------------------|---------------------------------|-----------------------------|------------|
| <b>Finfishes:</b>   |                                 |                             |            |
| HEMIRAMPHIDAE       | <i>Hyporhamphus australis</i>   | Eastern sea garfish         | x          |
| HEMIRAMPHIDAE       | <i>Hyporhamphus regularis</i>   | River garfish               | -          |
| MONACANTHIDAE       | <i>Meuschenia australis</i>     | Brown striped leatherjacket | -          |
| MONODACTYLIDAE      | <i>Monodactylus argenteus</i>   | Diamond fish                | -          |
| MUGILIDAE           | <i>Liza argentea</i>            | Flat-tail mullet            | x          |
| MUGILIDAE           | <i>Mugil cephalus</i>           | Sea mullet                  | x          |
| MUGILIDAE           | <i>Myxus elongatus</i>          | Sand mullet                 | -          |
| MURAENESOCIDAE      | <i>Muraenesox bagio</i>         | Common pike eel             | -          |
| PERCICHTHYIDAE      | <i>Macquaria novemaculeata</i>  | Australian bass             | -          |
| PLATYCEPHALIDAE     | <i>Platycephalus arenarius</i>  | Northern sand flathead      | x          |
| PLATYCEPHALIDAE     | <i>Platycephalus fuscus</i>     | Dusky flathead              | x          |
| PLOTOSIDAE          | <i>Euristhmus lepturus</i>      | Long-tailed catfish         | -          |
| PLOTOSIDAE          | <i>Plotosis lineatus</i>        | Striped catfish             | -          |
| POMACENTRIDAE       | (unid. damsel)                  | Damsel fish                 | -          |
| POMATOMIDAE         | <i>Pomatomus saltatrix</i>      | Tailor                      | x          |
| PRIACANTHIDAE       | <i>Priacanthus macracanthus</i> | Red bigeye                  | -          |
| SCATOPHAGIDAE       | <i>Selenotoca multifasciata</i> | Old maid                    | -          |
| SCIAENIDAE          | <i>Argyrosomus japonicus</i>    | Jewfish                     | x          |
| SCORPAENIDAE        | <i>Notesthes robusta</i>        | Bullrout                    | -          |
| SCORPAENIDAE        | <i>Pterois volitans</i>         | Red firefish                | -          |
| SILLAGINIDAE        | <i>Sillago ciliata</i>          | Sand whiting                | x          |
| SILLAGINIDAE        | <i>Sillago maculata</i>         | Trumpeter whiting           | x          |
| SOLEIDAE            | <i>Synclidopus macleayanus</i>  | Narrow banded sole          | -          |
| SOLEIDAE            | <i>Synaptura nigra</i>          | Black sole                  | -          |
| SPARIDAE            | <i>Acanthopagrus australis</i>  | Bream                       | x          |
| SPARIDAE            | <i>Rhabdosargus sarba</i>       | Tarwhine                    | x          |
| TERAPONTIDAE        | <i>Pelates sexlineatus</i>      | Trumpeter                   | -          |
| TETRAODONTIDAE      | (assorted toadfish/pufferfish)  | Toadfish/pufferfish         | -          |
| TRICHIURIDAE        | <i>Trichiurus lepturus</i>      | Hairtail                    | x          |
| URANOSCOPIDAE       | <i>Ichthyoscopus lebeck</i>     | Spotted stargazer           | -          |
| <b>Crustaceans:</b> |                                 |                             |            |
| GRAPSIDAE           | <i>Scylla serrata</i>           | Mud crab                    | x          |
| PALAEMONIDAE        | Macrobrachium sp.               | Long armed prawn            | -          |
| PORTUNIDAE          | <i>Portunus pelagicus</i>       | Blue swimmer crab           | x          |

<sup>4</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.



**Table AB2.** List of incidental taxa caught during observer based surveys of the Estuary Prawn Trawl Fleet in Lake Wooloweyah<sup>5</sup>.

| Family                        | Scientific name                    | Common name                | Commercial |
|-------------------------------|------------------------------------|----------------------------|------------|
| <b>Finfishes</b>              |                                    |                            |            |
| AMBASSIDAE                    | <i>Ambassis jacksoniensis</i>      | Port jackson perchlet      | -          |
| AMBASSIDAE                    | <i>Ambassis marianus</i>           | Ramseys perchlet           | -          |
| ANGUILLIDAE                   | <i>Anguilla australis</i>          | Short finned eel           | -          |
| APOGONIDAE                    | <i>Siphamia roseigaster</i>        | Pink breasted siphonfish   | -          |
| ARIIDAE                       | <i>Arius graeffei</i>              | Fork tailed catfish        | -          |
| BOTHIDAE                      | <i>Pseudorhombus arsius</i>        | Large toothed flounder     | x          |
| BOTHIDAE                      | <i>Pseudorhombus jenynsii</i>      | Small toothed flounder     | x          |
| CARANGIDAE                    | <i>Gnathanodon speciosus</i>       | Golden trevally            | x          |
| CARANGIDAE                    | <i>Scomberoides commersonianus</i> | Queenfish                  | -          |
| CARANGIDAE                    | <i>Trachurus novaezelandiae</i>    | Yellowtail                 | -          |
| CLUPEIDAE                     | <i>Herklotsichthys castelnaui</i>  | Southern herring           | -          |
| CLUPEIDAE                     | <i>Hyperlophus vittatus</i>        | Sandy sprat                | -          |
| CLUPEIDAE                     | <i>Potamalosa richmondia</i>       | Freshwater herring         | -          |
| CONGRIDAE                     | <i>Conger wilsoni</i>              | Congor eel                 | -          |
| DASYATIDIDAE /<br>UROLOPHIDAE | Stingray/stingaree                 | Stingray/stingaree         | -          |
| DINOLESTIDAE                  | <i>Dinolestes lewini</i>           | Long-finned pike           | -          |
| ELEOTRIDAE                    | <i>Hypseleotris compressus</i>     | Empire gudgeon             | -          |
| ELEOTRIDAE                    | <i>Philypnodon grandiceps</i>      | Large-headed gudgeon       | -          |
| ELOPIDAE                      | <i>Elops machnata</i>              | Giant herring              | -          |
| EXOCOETIDAE                   | <i>Arrhamphus sclerolepis</i>      | Snub-nosed garfish         | -          |
| GERREIDAE                     | <i>Gerres subfasciatus</i>         | Common silver biddy        | -          |
| GIRRELIDAE                    | <i>Girella tricuspidata</i>        | Blackfish                  | x          |
| GOBIIDAE                      | <i>Arenigobius bifrenatus</i>      | Bridled goby               | -          |
| GOBIIDAE                      | <i>Arenigobius frenatus</i>        | Half bridled goby          | -          |
| GOBIIDAE                      | <i>Brachyambloypus coecus</i>      | Blind goby                 | -          |
| GOBIIDAE                      | <i>Favonigobius tamarensis</i>     | Tamar river goby           | -          |
| GOBIIDAE                      | <i>Redigobius macrostoma</i>       | Large mouth goby           | -          |
| HAEMULIIDAE                   | <i>Pomadasys opercularis</i>       | Small spotted javelin fish | -          |
| HEMIRAMPHIDAE                 | <i>Hyporhamphus australis</i>      | Eastern sea garfish        | x          |
| HEMIRAMPHIDAE                 | <i>Hyporhamphus regularis</i>      | River garfish              | -          |
| LUTJANIDAE                    | <i>Lutjanus russelli</i>           | Moses perch                | -          |
| MONACANTHIDAE                 | <i>Eubalichthys mosaicus</i>       | Mosaic leatherjacket       | x          |
| MONODACTYLIDAE                | <i>Monodactylus argenteus</i>      | Diamond fish               | -          |

<sup>5</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB2 (cont)<sup>6</sup>.

| Family              | Scientific name                 | Common name            | Commercial |
|---------------------|---------------------------------|------------------------|------------|
| <b>Finfishes</b>    |                                 |                        |            |
| MUGILIDAE           | <i>Liza argentea</i>            | Flat-tail mullet       | x          |
| MUGILIDAE           | <i>Mugil cephalus</i>           | Sea mullet             | x          |
| MUGILIDAE           | <i>Myxus elongatus</i>          | Sand mullet            | -          |
| MURAENESOCIDAE      | <i>Muraenesox bagio</i>         | Common pike eel        | -          |
| PERCICHTHYIDAE      | <i>Macquaria colonorum</i>      | Estuary perch          | -          |
| PLATYCEPHALIDAE     | <i>Platycephalus arenarius</i>  | Northern sand flathead | x          |
| PLATYCEPHALIDAE     | <i>Platycephalus fuscus</i>     | Dusky flathead         | x          |
| PLOTOSIDAE          | <i>Euristhmus lepturus</i>      | Long-tailed catfish    | -          |
| PLOTOSIDAE          | <i>Plotosis lineatus</i>        | Striped catfish        | -          |
| POMATOMIDAE         | <i>Pomatomus saltatrix</i>      | Tailor                 | x          |
| PRIACANTHIDAE       | <i>Priacanthus macracanthus</i> | Red bigeye             | -          |
| SCATOPHAGIDAE       | <i>Selenotoca multifasciata</i> | Old maid               | -          |
| SCIAENIDAE          | <i>Argyrosomus japonicus</i>    | Jewfish                | -          |
| SCORPAENIDAE        | <i>Notesthes robusta</i>        | Bullrout               | -          |
| SILLAGINIDAE        | <i>Sillago ciliata</i>          | Sand whiting           | x          |
| SILLAGINIDAE        | <i>Sillago maculata</i>         | Trumpeter whiting      | x          |
| SOLEIDAE            | <i>Synclidopus macleayanus</i>  | Narrow banded sole     | -          |
| SOLEIDAE            | <i>Synaptura nigra</i>          | Black sole             | -          |
| SPARIDAE            | <i>Acanthopagrus australis</i>  | Bream                  | x          |
| SPARIDAE            | <i>Pagrus auratus</i>           | Snapper                | x          |
| SPARIDAE            | <i>Rhabdosargus sarba</i>       | Tarwhine               | x          |
| TERAPONTIDAE        | <i>Pelates sexlineatus</i>      | Trumpeter              | -          |
| TETRAODONTIDAE      | (assorted toadfish/pufferfish)  | Toadfish/pufferfish    | -          |
| <b>Crustaceans:</b> |                                 |                        |            |
| GRAPSIDAE           | <i>Scylla serrata</i>           | Mud crab               | x          |
| PENAEIDAE           | <i>Penaeus esculentus</i>       | Tiger prawn            | x          |
| PENAEIDAE           | <i>Penaeus monodon</i>          | Leader prawn           | x          |
| PORTUNIDAE          | <i>Portunus pelagicus</i>       | Blue swimmer crab      | x          |
| SQUILLIDAE          | <i>Squilla</i> sp.              | Mantis shrimp          | -          |
| <b>Molluscs:</b>    |                                 |                        |            |
| LOLIGINIDAE         | <i>Loliolus</i> sp.             | Bottle squid           | x          |

<sup>6</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

**Table AB3.** List of incidental taxa caught during fishery independent surveys by Ruello (1971) from the Hunter River<sup>7</sup>.

| Family                        | Scientific name                        | Common name                | Commercial |
|-------------------------------|----------------------------------------|----------------------------|------------|
| <b>Finfishes:</b>             |                                        |                            |            |
| ANGUILLIDAE                   | <i>Anguilla australis</i>              | Short finned eel           | x          |
| ANGUILLIDAE                   | <i>Anguilla reinhardtii</i>            | Long finned eel            | x          |
| ANTENNARIIDAE                 | <i>Antennarius spp.triatus</i>         | YellowA anglerfish         | -          |
| AMBASSIDA                     | <i>Ambassis sp.</i>                    | Perchlet                   | -          |
| BOTHIDAE                      | <i>Pseudorhombus jenynsii</i>          | Small-toothed flounder     | x          |
| CARANGIDAE                    | <i>Trachurus novaezelandiae</i>        | Yellowtail                 | -          |
| CARANGIDAE                    | <i>Caranx sansun</i>                   | Papuan trevally            | -          |
| CARANGIDAE                    | <i>Pseudocaranx dentex</i>             | Skipjack trevally          | -          |
| CLUPEIDAE                     | <i>Potamalosa richmondia</i>           | Freshwater herring         | x          |
| CLUPEIDAE                     | <i>Sardinops neopilchardus</i>         | Pilchard                   | x          |
| DASYATIDIDAE /<br>UROLOPHIDAE | Stingray/stingaree                     | Stingray/stingaree         | x          |
| DIDONTIDAE                    | <i>Dicotylichthys punctulatus</i>      | Porcupine fish             | -          |
| ELEOTRIDE                     | <i>Philynodon grandiceps</i>           | Flat-headed gudgeon        | -          |
| ELOPIDAE                      | <i>Elops machnata</i>                  | Giant herring              | -          |
| ENOPLOSIDAE                   | <i>Enoplosus armatus</i>               | Old wife                   | -          |
| GERREIDAE                     | <i>Gerres subfasciatus</i>             | Common silver biddy        | x          |
| GOBIIDAE                      | <i>Favonigobius lateralis</i>          | Sand Goby                  | -          |
| GOBIIDAE                      | -                                      | Goby various               | -          |
| HEMIRAMPHIDAE                 | <i>Hyporhamphus regularis</i>          | River Garfish              | x          |
| LUTJANIDAE                    | <i>Lutjanus argentimaculatus</i>       | Mangrove Jack              | x          |
| MONOCENTRIDAE                 | <i>Cleidopus gloriamaris</i>           | Knight fish                | -          |
| MONACANTHIDAE                 | <i>Monacanthus chinensis</i>           | Fanbellied leatherjacket   | x          |
| MONODACTYLIDAE                | <i>Monodactylus argenteus</i>          | Silver batfish             | -          |
| MORIDAE                       | <i>Pseudophycis barbatarevivsculus</i> | Bearded cod                | -          |
| MUGILIDAE                     | <i>Mugil cephalus</i>                  | Sea mullet                 | x          |
| MUGILIDAE                     | -                                      | Unidentified mullet        | x          |
| MURAENOSIDAE                  | <i>Muraenesox bagio</i>                | Pike eel                   | x          |
| PERCICHTHYIDAE                | <i>Macquaria colonorum</i>             | Estuary perch              | -          |
| PERCICHTHYIDAE                | <i>Macquaria novemaculeata</i>         | Australian bass            | -          |
| PLATYCEPHALIDAE               | <i>Platycephalus caeruleopunctatus</i> | Eastern blue spot flathead | x          |
| PLATYCEPHALIDAE               | <i>Platycephalus fuscus</i>            | Dusky flathead             | x          |
| PLOTOSIDAE                    | <i>Euristhmus lepturus</i>             | Long-tailed catfish        | -          |
| POMATOMIDAE                   | <i>Pomatomus saltatrix</i>             | Tailor                     | x          |
| PRIACANTHIDAE                 | <i>Priacanthus macracanthus</i>        | Red bullseye               | -          |

<sup>7</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB3 (cont)<sup>8</sup>.

| Family              | Scientific name                  | Common name          | Commercial |
|---------------------|----------------------------------|----------------------|------------|
| <b>Finfishes:</b>   |                                  |                      |            |
| POECILIDAE          | <i>Gambusia holbrooki</i>        | Mosquito fish        | -          |
| SCIAENIDAE          | <i>Argyrosomus japonicus</i>     | Jewfish              | x          |
| SCATOPHAGIDAE       | <i>Scatopagus argus</i>          | Tiger scat           | -          |
| SCATOPHAGIDAE       | <i>Scatopagus multifasciatus</i> | Many banded scat     | -          |
| SCORPAENIDAE        | <i>Centropogon australis</i>     | Eastern fortesque    | -          |
| SCORPAENIDAE        | <i>Notesthes robusta</i>         | Bullrout             | -          |
| SILLAGINIDAE        | <i>Sillago ciliata</i>           | Sand whiting         | x          |
| SILLAGINIDAE        | <i>Sillago flindersi</i>         | Red spot whiting     | x          |
| SILLAGINIDAE        | <i>Sillago maculata</i>          | Trumpeter whiting    | x          |
| SOLEIDAE            | <i>Synclidopus macleayanus</i>   | Narrow banded sole   | -          |
| SPARIDAE            | <i>Acanthopagrus australis</i>   | Yellow fin bream     | x          |
| SPHYRAENIDAE        | <i>Sphyræna novaehollandiae</i>  | Short finned seapike | -          |
| TETRAODONTIDAE      | <i>Tetractenos hamiltoni</i>     | Common toadfish      | -          |
| TRIGLIDAE           | <i>Chelidonichthys kumu</i>      | Red gurnard          | x          |
| <b>Crustaceans:</b> |                                  |                      |            |
| ALPHEIDAE           | <i>Alpheus edwardsi</i>          | Common pistol shrimp | -          |
| ATYIDAE             | <i>Paratya</i> sp.               | -                    | -          |
| HIPPOLYTIDAE        | -                                | Hunchback prawn      | -          |
| MYSIDAE             | -                                | Possum srimp         | -          |
| PALAEMONIDAE        | <i>Macrobrachium</i> sp.         | Long arm prawn       | x          |
| PENAEIDAE           | <i>Metapenaeus bennettiae</i>    | Greasyback prawn     | x          |
| PENAEIDAE           | <i>Penaeus plebejus</i>          | Eastern king prawn   | x          |
| PENAEIDAE           | <i>Penaeus monodon</i>           | Black tiger prawn    | x          |
| PORTUNIDAE          | <i>Charybdis cruciata</i>        | Coral crab           | x          |
| PORTUNIDAE          | <i>Ovalipes australiensis</i>    | 2 spot crab          | x          |
| PORTUNIDAE          | <i>Portunus pelagicus</i>        | Blue swimmer crab    | x          |
| PORTUNIDAE          | <i>Portunus sanguinolentus</i>   | 3 spot crab          | x          |
| PORTUNIDAE          | <i>Scylla serrata</i>            | Mud crab             | x          |
| SERGESTIDAE         | <i>Acetes australis</i>          | -                    | -          |
| SQUILLIDAE          | <i>Squilla</i> sp.               | Mantis shrimp        | x          |

<sup>8</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

**Table AB4.** List of incidental taxa caught during observer based surveys of the Brooklyn trawl fleet (Hawkesbury River).<sup>9</sup>

| Family                        | Scientific name                   | Common name              | Commercial |
|-------------------------------|-----------------------------------|--------------------------|------------|
| <b>Finfishes:</b>             |                                   |                          |            |
| AMBASSIDAE                    | <i>Ambassis jacksoniensis</i>     | Port jackson perchlet    | -          |
| AMBASSIDAE                    | <i>Ambassis marianus</i>          | Ramseys perchlet         | -          |
| ANGUILLIDAE                   | <i>Anguilla australis</i>         | Short finned eel         | x          |
| ANTENNARIIDAE                 | <i>Antennarius striatus</i>       | Yellow anglerfish        | -          |
| APOGONIDAE                    | <i>Apogon</i> sp.                 | Cardinal fish            | -          |
| APOGONIDAE                    | <i>Siphamia roseigaster</i>       | Pink breasted siphonfish | -          |
| BERYCIDAE                     | <i>Centroberyx affinis</i>        | Redfish                  | x          |
| BOTHIDAE                      | <i>Pseudorhombus arsius</i>       | Large toothed flounder   | x          |
| BOTHIDAE                      | <i>Pseudorhombus jenynsii</i>     | Small toothed flounder   | x          |
| CALLIONYMIDAE                 | (unid. stinkfish)                 | Stinkfish                | -          |
| CARANGIDAE                    | <i>Gnathanodon speciosus</i>      | Golden trevally          | x          |
| CARANGIDAE                    | <i>Pseudocaranx dentex</i>        | Silver trevally          | x          |
| CARANGIDAE                    | <i>Seriola hippos</i>             | Samson fish              | x          |
| CARANGIDAE                    | <i>Trachurus novaezelandiae</i>   | Yellowtail               | x          |
| CHEILODACTYLIDAE              | <i>Cheilodactylus douglasi</i>    | Blue morwong             | x          |
| CHIRONEMIDAE                  | <i>Chironemus marmoratus</i>      | Eastern kelpfish         | -          |
| CLUPEIDAE                     | <i>Herklotsichthys castelnaui</i> | Southern herring         | x          |
| CLUPEIDAE                     | <i>Hyperlophus vittatus</i>       | Sandy sprat              | x          |
| CLUPEIDAE                     | <i>Potamalosa richmondia</i>      | Freshwater herring       | x          |
| CLUPEIDAE                     | <i>Sardinops neopilchardus</i>    | Pilchard                 | x          |
| CONGRIDAE                     | <i>Conger wilsoni</i>             | Congor eel               | x          |
| CYNOGLOSSIDAE                 | <i>Paraplagusia unicolor</i>      | Lemon tongue sole        | -          |
| CYPRINIDAE                    | <i>Cyprinus carpio</i>            | European carp            | -          |
| DASYATIDIDAE /<br>UROLOPHIDAE | Stingray/stingaree                | Stingray/stingaree       | x          |
| DIDONTIDAE                    | <i>Dicotylichthys punctulatus</i> | Porcupine fish           | -          |
| DINOLESTIDAE                  | <i>Dinolestes lewini</i>          | Long-finned pike         | -          |
| ELEOTRIDAE                    | <i>Gobiomorphus australis</i>     | Striped gudgeon          | -          |
| ELEOTRIDAE                    | <i>Philypnodon grandiceps</i>     | Large-headed gudgeon     | -          |
| ENOPLOSIDAE                   | <i>Enoplosus armatus</i>          | Old wife                 | -          |
| EPHIPPIDAE                    | <i>Platax tiera</i>               | Round faced batfish      | -          |
| GERREIDAE                     | <i>Gerres subfasciatus</i>        | Common silver biddy      | x          |
| GIRELLIDAE                    | <i>Girella tricuspidata</i>       | Blackfish                | x          |

<sup>9</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB4 (cont)<sup>10</sup>.

| Family            | Scientific name                        | Common name                | Commercial |
|-------------------|----------------------------------------|----------------------------|------------|
| <b>Finfishes:</b> |                                        |                            |            |
| GOBIIDAE          | (unid. gobies)                         | Goby                       | -          |
| GOBIIDAE          | <i>Acanthogobius flavimanus</i>        | Oriental goby              | -          |
| GOBIIDAE          | <i>Arenigobius bifrenatus</i>          | Bridled goby               | -          |
| GOBIIDAE          | <i>Bathygobius cocosensis</i>          | Common goby                | -          |
| GOBIIDAE          | <i>Bunaka herwerdenii</i>              | Mud gudgeon                | -          |
| GOBIIDAE          | <i>Favonigobius exquisitus</i>         | Exquisite goby             | -          |
| GOBIIDAE          | <i>Favonigobius tamarensis</i>         | Tamar river goby           | -          |
| GOBIIDAE          | <i>Favonigobius lateralis</i>          | Long finned goby           | -          |
| GOBIIDAE          | <i>Redigobius macrostoma</i>           | Large mouth goby           | -          |
| GOBIIDAE          | <i>Tridentiger trigonocephalus</i>     | Japanese goby              | -          |
| GOBIIDAE          | Trimma sp.                             | Red and white goby         | -          |
| GONORYNCHIDAE     | <i>Gonorynchus greyi</i>               | Beaked salmon              | -          |
| HETERODONTIDAE    | <i>Heterodontos portjacksoni</i>       | Port jackson shark         | -          |
| MONACANTHIDAE     | <i>Eubalichthys mosaicus</i>           | Mosaic leatherjacket       | x          |
| MONACANTHIDAE     | <i>Meuschenia trachylepis</i>          | Yellowfin leatherjacket    | x          |
| MONACANTHIDAE     | <i>Monacanthus chinensis</i>           | Fanbellied leatherjacket   | x          |
| MONACANTHIDAE     | <i>Paramonacanthus filicauda</i>       | Threadfin leatherjacket    | x          |
| MONODACTYLIDAE    | <i>Monodactylus argenteus</i>          | Diamond fish               | -          |
| MORIDAE           | <i>Pseudophycis breviusculus</i>       | Bearded cod                | -          |
| MUGILIDAE         | <i>Liza argentea</i>                   | Flat-tail mullet           | x          |
| MUGILIDAE         | <i>Mugil cephalus</i>                  | Sea mullet                 | x          |
| MUGILIDAE         | <i>Mugil georgii</i>                   | Fantail mullet             | x          |
| MUGILIDAE         | <i>Myxus elongatus</i>                 | Sand mullet                | x          |
| MURAENESOCIDAE    | <i>Muraenesox bagio</i>                | Common pike eel            | x          |
| PERCICHTHYIDAE    | <i>Macquaria colonorum</i>             | Estuary perch              | -          |
| PERCICHTHYIDAE    | <i>Macquaria novemaculeata</i>         | Australian bass            | -          |
| PLATYCEPHALIDAE   | <i>Platycephalus arenarius</i>         | Northern sand flathead     | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus caeruleopunctatus</i> | Eastern blue spot flathead | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus fuscus</i>            | Dusky flathead             | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus longispinus</i>       | Long spined flathead       | -          |
| PLATYCEPHALIDAE   | <i>Suggrundus jugosis</i>              | Mud flathead               | x          |
| PLOTOSIDAE        | <i>Euristhmus lepturus</i>             | Long-tailed catfish        | -          |
| PLOTOSIDAE        | <i>Plotosis lineatus</i>               | Striped catfish            | -          |
| POMATOMIDAE       | <i>Pomatomus saltatrix</i>             | Tailor                     | x          |
| PRIACANTHIDAE     | <i>Priacanthus macracanthus</i>        | Red bigeye                 | -          |
| RHINOBATIDAE      | <i>Aptychotrema rostrata</i>           | Shovelnose ray             | x          |
| SCATOPHAGIDAE     | <i>Selenotoca multifasciata</i>        | Old maid                   | -          |
| SCIAENIDAE        | <i>Argyrosomus japonicus</i>           | Jewfish                    | x          |
| SCIAENIDAE        | <i>Atractoscion aequidens</i>          | Teraglin                   | x          |
| SCOMBRIDAE        | <i>Sardinella lemuru</i>               | Scaly mackerel             | -          |
| SCORPAENIDAE      | <i>Centropogon australis</i>           | Eastern fortesque          | -          |
| SCORPAENIDAE      | <i>Notesthes robusta</i>               | Bullrout                   | -          |

<sup>10</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB4 (cont)<sup>11</sup>.

| Family              | Scientific name                | Common name         | Commercial |
|---------------------|--------------------------------|---------------------|------------|
| <b>Finfishes:</b>   |                                |                     |            |
| SILLAGINIDAE        | <i>Sillago ciliata</i>         | Sand whiting        | x          |
| SILLAGINIDAE        | <i>Sillago flindersi</i>       | Red spot whiting    | x          |
| SILLAGINIDAE        | <i>Sillago maculata</i>        | Trumpeter whiting   | x          |
| SILLAGINIDAE        | <i>Sillago robusta</i>         | Stout whiting       | x          |
| SOLEIDAE            | <i>Synclidopus macleayanus</i> | Narrow banded sole  | -          |
| SOLEIDAE            | <i>Synaptura nigra</i>         | Black sole          | -          |
| SPARIDAE            | <i>Acanthopagrus australis</i> | Bream               | x          |
| SPARIDAE            | <i>Pagrus auratus</i>          | Snapper             | x          |
| SPARIDAE            | <i>Rhabdosargus sarba</i>      | Tarwhine            | x          |
| SYNGNATHIDAE        | (unid. pipefish)               | Pipefish            | -          |
| TANIODIDAE          | <i>Taenioides mordax</i>       | Eel goby            | -          |
| TERAPONTIDAE        | <i>Pelates quadrilineatus</i>  | Trumpeter           | x          |
| TETRAODONTIDAE      | (assorted toadfish/pufferfish) | Toadfish/pufferfish | -          |
| TRICHIURIDAE        | <i>Trichiurus lepturus</i>     | Hairtail            | x          |
| TRIGLIDAE           | <i>Chelidonichthys kumu</i>    | Red gurnard         | x          |
| (UNID. EELS)        | (unid. eels)                   | Eel                 | x          |
| (UNID. PERCHLET)    | (unid. perchlet)               | Unid. perchlet      |            |
| <b>Reptiles:</b>    |                                |                     |            |
| (UNID. SEASNAKES)   | (unid. seasnakes)              | Seasnake            | -          |
| <b>Crustaceans:</b> |                                |                     |            |
| ALPHEIDAE           | <i>Alpheus</i> spp.            | Snapping shrimp     | -          |
| GRAPSIDAE           | <i>Scylla serrata</i>          | Mud crab            | x          |
| PALAEMONIDAE        | <i>Macrobrachium</i> sp.       | Long armed prawn    | -          |
| PORTUNIDAE          | <i>Charybdis cruciata</i>      | Coral crab          | x          |
| PORTUNIDAE          | <i>Portunus pelagicus</i>      | Blue swimmer crab   | x          |
| PORTUNIDAE          | <i>Portunus sanguinolentus</i> | 3 spot crab         | x          |
| SQUILLIDAE          | <i>Squilla</i> sp.             | Mantis shrimp       | x          |
| (UNID. CRABS)       | (unid. crabs)                  | Crab                | x          |
| <b>Molluscs:</b>    |                                |                     |            |
| LOLIGINIDAE         | <i>Loligo chinensis</i>        | Broad squid         | x          |
| LOLIGINIDAE         | <i>Loligo</i> sp.              | Slender squid       | x          |
| LOLIGINIDAE         | <i>Loliolus</i> sp.            | Bottle squid        | x          |
| OCTOPODA (ORDER)    | (unid. octopi)                 | Octopus             | x          |
| SEPIOLIDAE          | <i>Euprymna stenodactyla</i>   | Bubble squid        | x          |
| TEUTHOIDAE          | <i>Nototodarus gouldi</i>      | Arrow squid         | x          |
| (UNID. SQUID)       | (unid. squid)                  | Unid. squid         | x          |

<sup>11</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.



**Table AB5.** List of incidental taxa caught during observer based surveys of the squid fleet on the Hawkesbury River<sup>12</sup>.

| Family                        | Scientific name                   | Common name              | Commercial |
|-------------------------------|-----------------------------------|--------------------------|------------|
| <b>Finfish:</b>               |                                   |                          |            |
| AMBASSIDAE                    | <i>Ambassis jacksoniensis</i>     | Port jackson perchlet    | -          |
| AMBASSIDAE                    | <i>Ambassis marianus</i>          | Ramseys perchlet         | -          |
| ANTENNARIIDAE                 | <i>Antennarius striatus</i>       | Yellow anglerfish        | -          |
| APOGONIDAE                    | <i>Apogon</i> sp.                 | Cardinal fish            | -          |
| APOGONIDAE                    | <i>Gronovichthys atripes</i>      | Two-eyed cardinal fish   | -          |
| APOGONIDAE                    | <i>Siphamia roseigaster</i>       | Pink breasted siphonfish | -          |
| ATHERINIDAE                   | <i>Pranesus ogilbyi</i>           | Ogilby's hardy head      | -          |
| BLENNIIDAE                    | <i>Petroscirtes lupus</i>         | Sabretooth blenny        | -          |
| BOTHIDAE                      | <i>Pseudorhombus arsius</i>       | Large toothed flounder   | x          |
| BOTHIDAE                      | <i>Pseudorhombus jenynsii</i>     | Small toothed flounder   | x          |
| CALLIONYMIDAE                 | (unid. stinkfish)                 | Stinkfish                | -          |
| CARANGIDAE                    | <i>Gnathanodon speciosus</i>      | Golden trevally          | x          |
| CARANGIDAE                    | <i>Pseudocaranx dentex</i>        | Silver trevally          | x          |
| CARANGIDAE                    | <i>Trachurus novaezelandiae</i>   | Yellowtail               | x          |
| CENTROLOPHIDAE                | <i>Seriolella brama</i>           | Warehou                  | x          |
| CLUPEIDAE                     | <i>Herklotsichthys castelnaui</i> | Southern herring         | x          |
| CLUPEIDAE                     | <i>Hyperlophus vittatus</i>       | Sandy sprat              | x          |
| CLUPEIDAE                     | <i>Sardinops neopilchardus</i>    | Pilchard                 | x          |
| CONGRIDAE                     | <i>Conger wilsoni</i>             | Congor eel               | x          |
| DASYATIDIDAE /<br>UROLOPHIDAE | Stingray/stingaree                | Stingray/stingaree       | x          |
| DIDONTIDAE                    | <i>Dicotylichthys punctulatus</i> | Porcupine fish           | -          |
| DINOLESTIDAE                  | <i>Dinolestes lewini</i>          | Long-finned pike         | -          |
| ENOPLOSIDAE                   | <i>Enoplosus armatus</i>          | Old wife                 | -          |
| GERREIDAE                     | <i>Gerres subfasciatus</i>        | Common silver biddy      | x          |
| GIRELLIDAE                    | <i>Girella tricuspidata</i>       | Blackfish                | x          |
| HETERODONTIDAE                | <i>Heterodontos portjacksoni</i>  | Port jackson shark       | -          |
| LEIOGNATHIDAE                 | <i>Leignathus</i> sp.             | Pony fish                | -          |
| MONACANTHIDAE                 | <i>Brachaluteres jacksonianus</i> | Pygmy leatherjacket      | -          |
| MONACANTHIDAE                 | <i>Eubalichthys mosaicus</i>      | Mosaic leatherjacket     | x          |
| MONACANTHIDAE                 | <i>Meuschenia freycineti</i>      | Six-spined leatherjacket | x          |
| MONACANTHIDAE                 | <i>Meuschenia trachylepis</i>     | Yellowfin leatherjacket  | x          |
| MONACANTHIDAE                 | <i>Monacanthus chinensis</i>      | Fanbellied leatherjacket | x          |
| MONACANTHIDAE                 | <i>Paramonacanthus filicauda</i>  | Threadfin leatherjacket  | x          |
| MONODACTYLIDAE                | <i>Monodactylus argenteus</i>     | Diamond fish             | -          |
| MONODACTYLIDAE                | <i>Schuetta scalaripinnis</i>     | Ladder-finned pomfret    | -          |

<sup>12</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.



Table AB5 (cont)<sup>13</sup>.

| Family          | Scientific name                        | Common name                | Commercial |
|-----------------|----------------------------------------|----------------------------|------------|
| <b>Finfish:</b> |                                        |                            |            |
| MUGILIDAE       | <i>Liza argentea</i>                   | Flat-tail mullet           | x          |
| MUGILIDAE       | <i>Mugil cephalus</i>                  | Sea mullet                 | x          |
| MUGILIDAE       | <i>Mugil georgii</i>                   | Fantail mullet             | -          |
| MULLIDAE        | <i>Upeneus tragula</i>                 | Bartailed goatfish         | x          |
| MURAENESOCIDAE  | <i>Muraenesox bagio</i>                | Common pike eel            | x          |
| MYLIOBATIDAE    | <i>Myliobatis australis</i>            | Eagle ray                  | -          |
| OSTRACIIDAE     | (unid. boxfish)                        | Boxfish                    | -          |
| OSTRACIIDAE     | <i>Tetrosomus republicae</i>           | Turret fish                | -          |
| PEMPHERIDIDAE   | <i>Pempheris analis</i>                | Bronze bullseye            | -          |
| PEMPHERIDIDAE   | <i>Pempheris compressa</i>             | Deep bullseye              | -          |
| PEMPHERIDIDAE   | <i>Pempheris multiradiatus</i>         | Common bullseye            | -          |
| PLATYCEPHALIDAE | <i>Platycephalus arenarius</i>         | Northern sand flathead     | x          |
| PLATYCEPHALIDAE | <i>Platycephalus caeruleopunctatus</i> | Eastern blue spot flathead | x          |
| PLATYCEPHALIDAE | <i>Platycephalus fuscus</i>            | Dusky flathead             | x          |
| PLATYCEPHALIDAE | <i>Platycephalus longispinus</i>       | Long spined flathead       | -          |
| PLATYCEPHALIDAE | <i>Suggrundus jugosis</i>              | Mud flathead               | x          |
| PLOTOSIDAE      | <i>Euristhmus lepturus</i>             | Long-tailed catfish        | -          |
| PLOTOSIDAE      | <i>Plotosis lineatus</i>               | Striped catfish            | -          |
| POMATOMIDAE     | <i>Pomatomus saltatrix</i>             | Tailor                     | x          |
| PRIACANTHIDAE   | <i>Priacanthus macracanthus</i>        | Red bigeye                 | -          |
| RAJIDAE         | Raja spp.                              | Skate                      | -          |
| RHINOBATIDAE    | <i>Aptychotrema rostrata</i>           | Shovelnose ray             | x          |
| RHINOBATIDAE    | Trygonorrhina sp.                      | Banjo ray                  | x          |
| SCATOPHAGIDAE   | <i>Selenotoca multifasciata</i>        | Old maid                   | -          |
| SCIAENIDAE      | <i>Argyrosomus japonicus</i>           | Jewfish                    | x          |
| SCIAENIDAE      | <i>Atractoscion aequidens</i>          | Teraglin                   | x          |
| SCOMBRIDAE      | <i>Scomber australasicus</i>           | Blue mackerel              | x          |
| SCORPAENIDAE    | <i>Centropogon australis</i>           | Eastern fortesque          | -          |
| SCORPAENIDAE    | <i>Notesthes robusta</i>               | Bullrout                   | -          |
| SCORPIDIDAE     | <i>Microcanthus strigatus</i>          | Stripey                    | -          |
| SCORPIDIDAE     | <i>Scorpiis lineolatus</i>             | Sweep                      | x          |
| SILLAGINIDAE    | <i>Sillago ciliata</i>                 | Sand whiting               | x          |
| SILLAGINIDAE    | <i>Sillago flindersi</i>               | Red spot whiting           | x          |
| SILLAGINIDAE    | <i>Sillago maculata</i>                | Trumpeter whiting          | x          |
| SILLAGINIDAE    | <i>Sillago robusta</i>                 | Stout whiting              | x          |

<sup>13</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB5 (cont)<sup>14</sup>.

| Family              | Scientific name                | Common name           | Commercial |
|---------------------|--------------------------------|-----------------------|------------|
| <b>Finfish:</b>     |                                |                       |            |
| SOLEIDAE            | <i>Synclidopus macleayanus</i> | Narrow banded sole    | -          |
| SOLEIDAE            | <i>Synaptura nigra</i>         | Black sole            | -          |
| SPARIDAE            | <i>Acanthopagrus australis</i> | Bream                 | x          |
| SPARIDAE            | <i>Pagrus auratus</i>          | Snapper               | x          |
| SPARIDAE            | <i>Rhabdosargus sarba</i>      | Tarwhine              | x          |
| SPHYRAENIDAE        | <i>Sphyraena africana</i>      | Snook                 | -          |
| SPYRNIDAE           | <i>Sphyrna lewini</i>          | Hammerhead shark      | x          |
| SYNODONTIDAE        | <i>Trachinocephalus myops</i>  | Painted grinner       | -          |
| TERAPONTIDAE        | <i>Pelates quadrilineatus</i>  | Trumpeter             | x          |
| TETRAODONTIDAE      | (assorted toadfish/pufferfish) | Toadfish / pufferfish | -          |
| TRACHICHTHYIDAE     | <i>Optivus elongatus</i>       | Slender roughy        | -          |
| TRICHIURIDAE        | <i>Trichiurus lepturus</i>     | Hairtail              | x          |
| TRIGLIDAE           | (unid. gurnard)                | Unid. gurnard         | -          |
| TRIGLIDAE           | <i>Chelidonichthys kumu</i>    | Red gurnard           | x          |
| ZEIDAE              | <i>Zeus faber</i>              | John dory             | x          |
| <b>Reptiles:</b>    |                                |                       |            |
| (UNID. TURTLE)      | (unid. turtle)                 | Turtle                | -          |
| <b>Crustaceans:</b> |                                |                       |            |
| ALPHEIDAE           | <i>Alpheus</i> spp.            | Snapping shrimp       | -          |
| GRAPSIDAE           | <i>Scylla serrata</i>          | Mud crab              | x          |
| PALINURIDAE         | <i>Jasus verreauxi</i>         | Eastern cray          | x          |
| PENAEIDAE           | <i>Metapenaeus bennettiae</i>  | Greasyback prawn      | x          |
| PENAEIDAE           | <i>Metapenaeus macleayi</i>    | School prawn          | x          |
| PENAEIDAE           | <i>Penaeus esculentus</i>      | Tiger prawn           | x          |
| PENAEIDAE           | <i>Penaeus plebejus</i>        | King prawn            | x          |
| PORTUNIDAE          | <i>Charybdis cruciata</i>      | Coral crab            | x          |
| PORTUNIDAE          | <i>Ovalipes australiensis</i>  | 2 spot crab           | -          |
| PORTUNIDAE          | <i>Portunus pelagicus</i>      | Blue swimmer crab     | x          |
| PORTUNIDAE          | <i>Portunus sanguinolentus</i> | 3 spot crab           | x          |
| SQUILLIDAE          | <i>Squilla</i> sp.             | Mantis shrimp         | x          |
| (UNID. CRABS)       | (unid. crabs)                  | Crab                  | x          |
| <b>Molluscs:</b>    |                                |                       |            |
| LOLIGINIDAE         | <i>Loligo</i> sp.              | Slender squid         | x          |
| LOLIGINIDAE         | <i>Loliolus</i> sp.            | Bottle squid          | x          |
| OCTOPODA (ORDER)    | (unid. octopi)                 | Octopus               | x          |
| SEPIIDAE            | <i>Sepia</i> sp.               | Cuttlefish            | x          |
| SEPIOLIDAE          | <i>Euprymna stenodactyla</i>   | Bubble squid          | -          |
| SEPIOLIDAE          | <i>Sepioida lineolata</i>      | Candy stripe squid    | x          |

<sup>14</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

**Table AB6.** List of incidental taxa caught during observer based surveys of the Estuary Prawn Trawl Fleet in Port Jackson.<sup>15</sup>

| Family                     | Scientific name                    | Common name              | Commercial |
|----------------------------|------------------------------------|--------------------------|------------|
| <b>Finfishes:</b>          |                                    |                          |            |
| AMBASSIDAE                 | <i>Ambassis jacksoniensis</i>      | Port jackson perchlet    | -          |
| AMBASSIDAE                 | <i>Ambassis marianus</i>           | Ramseys perchlet         | -          |
| ANTENNARIIDAE              | <i>Antennarius striatus</i>        | Yellow anglerfish        | -          |
| APOGONIDAE                 | <i>Apogon cooki</i>                | Cooks soldier fish       | -          |
| APOGONIDAE                 | <i>Apogon</i> sp.                  | Cardinal fish            | -          |
| APOGONIDAE                 | <i>Gronovichthys atripes</i>       | Two-eyed cardinal fish   | -          |
| APOGONIDAE                 | <i>Siphamia cephalotes</i>         | Woods siphonfish         | -          |
| APOGONIDAE                 | <i>Siphamia roseigaster</i>        | Pink breasted siphonfish | -          |
| BATRACHOIDIDAE             | <i>Batrachomoeus dubius</i>        | Eastern frogfish         | -          |
| BERYCIDAE                  | <i>Centroberyx affinis</i>         | Redfish                  | x          |
| BOTHIDAE                   | <i>Engyprosodon grandisquamma</i>  | Spiny-headed flounder    | -          |
| BOTHIDAE                   | <i>Pseudorhombus arsius</i>        | Large toothed flounder   | x          |
| BOTHIDAE                   | <i>Pseudorhombus jenynsii</i>      | Small toothed flounder   | x          |
| CALLIONYMIDAE              | (unid. stinkfish)                  | Stinkfish                | -          |
| CARANGIDAE                 | <i>Pseudocaranx dentex</i>         | Silver trevally          | x          |
| CARANGIDAE                 | <i>Trachurus novaezelandiae</i>    | Yellowtail               | x          |
| CENTROLOPHIDAE             | <i>Seriola brama</i>               | Warehou                  | x          |
| CLUPEIDAE                  | <i>Hyperlophus vittatus</i>        | Sandy sprat              | x          |
| CONGRIDAE                  | <i>Conger wilsoni</i>              | Congor eel               | x          |
| DASYATIDIDAE / UROLOPHIDAE | Stingray/stingaree                 | Stingray/stingaree       | x          |
| DIDONTIDAE                 | <i>Dicotylichthys punctulatus</i>  | Porcupine fish           | -          |
| DINOLESTIDAE               | <i>Dinolestes lewini</i>           | Long-finned pike         | -          |
| ENOPLOSIDAE                | <i>Enoplosus armatus</i>           | Old wife                 | -          |
| GERREIDAE                  | <i>Gerres subfasciatus</i>         | Common silver biddy      | x          |
| GOBIIDAE                   | (unid. gobies)                     | Goby                     | -          |
| GOBIIDAE                   | <i>Acanthogobius flavimanus</i>    | Oriental goby            | -          |
| GOBIIDAE                   | <i>Arenigobius bifrenatus</i>      | Bridled goby             | -          |
| GOBIIDAE                   | <i>Favonigobius exquisitus</i>     | Exquisite goby           | -          |
| GOBIIDAE                   | <i>Favonigobius tamarensis</i>     | Tamar river goby         | -          |
| GOBIIDAE                   | <i>Favonigobius lateralis</i>      | Long finned goby         | -          |
| GOBIIDAE                   | <i>Tridentiger trigonocephalus</i> | Japanese goby            | -          |
| HETERODONTIDAE             | <i>Heterodontos portjacksoni</i>   | Port jackson shark       | -          |
| LEIOGNATHIDAE              | <i>Leignathus</i> sp.              | Pony fish                | -          |

<sup>15</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB6 (cont)<sup>16</sup>.

| Family            | Scientific name                        | Common name                 | Commercial |
|-------------------|----------------------------------------|-----------------------------|------------|
| <b>Finfishes:</b> |                                        |                             |            |
| MONACANTHIDAE     | (unid. leatherjackets)                 | Unid. leatherjacket         | x          |
| MONACANTHIDAE     | <i>Brachaluteres jacksonianus</i>      | Pygmy leatherjacket         | -          |
| MONACANTHIDAE     | <i>Meuschenia australis</i>            | Brown striped leatherjacket | x          |
| MONACANTHIDAE     | <i>Meuschenia freycineti</i>           | Six-spined leatherjacket    | x          |
| MONACANTHIDAE     | <i>Meuschenia trachylepis</i>          | Yellowfin leatherjacket     | x          |
| MONACANTHIDAE     | <i>Monacanthus chinensis</i>           | Fanbellied leatherjacket    | x          |
| MONACANTHIDAE     | <i>Nelusetta ayraudi</i>               | Chinaman leatherjacket      | x          |
| MONACANTHIDAE     | <i>Parika scaber</i>                   | Velvet leatherjacket        | x          |
| MONACANTHIDAE     | <i>Scobinichthys granulatus</i>        | Rough skin leatherjacket    | x          |
| MORIDAE           | <i>Pseudophycis breviusculus</i>       | Bearded cod                 | -          |
| MUGILIDAE         | <i>Mugil cephalus</i>                  | Sea mullet                  | x          |
| MUGILIDAE         | <i>Myxus elongatus</i>                 | Sand mullet                 | x          |
| MUGILIDAE         | <i>Myxus petardi</i>                   | Pink-eye mullet             | x          |
| MULLIDAE          | (unid. goatfish)                       | Goatfish                    | -          |
| MULLIDAE          | <i>Upeneichthys lineatus</i>           | Red mullet                  | x          |
| MULLIDAE          | <i>Upeneus tragula</i>                 | Bartailed goatfish          | x          |
| MURAENIDAE        | <i>Enchelycore ramosa</i>              | Mosaic moray                | -          |
| OPICHTHIDAE       | <i>Ophisurus serpens</i>               | Serpent eel                 | -          |
| ORECTOLOBIDAE     | (unid. wobbegongs)                     | Wobbegong                   | x          |
| OSTRACIIDAE       | (unid. boxfish)                        | Boxfish                     | -          |
| PEMPHERIDIDAE     | <i>Pempheris multiradiatus</i>         | Common bullseye             | -          |
| PLATYCEPHALIDAE   | <i>Platycephalus arenarius</i>         | Northern sand flathead      | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus caeruleopunctatus</i> | Eastern blue spot flathead  | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus fuscus</i>            | Dusky flathead              | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus longispinus</i>       | Long spined flathead        | -          |
| PLATYCEPHALIDAE   | <i>Ratabulus diversidens</i>           | Spikey flathead             | x          |
| PLATYCEPHALIDAE   | <i>Suggrundus jugosis</i>              | Mud flathead                | x          |
| PLEURONECTIDAE    | <i>Ammotretis rostratus</i>            | Long snouted flounder       | -          |
| PLOTOSIDAE        | <i>Euristhmus lepturus</i>             | Long-tailed catfish         | -          |
| PLOTOSIDAE        | <i>Plotosis lineatus</i>               | Striped catfish             | -          |
| POMATOMIDAE       | <i>Pomatomus saltatrix</i>             | Tailor                      | x          |
| PRIACANTHIDAE     | <i>Priacanthus macracanthus</i>        | Red bigeye                  | -          |
| SCATOPHAGIDAE     | <i>Selenotoca multifasciata</i>        | Old maid                    | -          |
| SCIAENIDAE        | <i>Argyrosomus japonicus</i>           | Jewfish                     | x          |
| SCIAENIDAE        | <i>Atractoscion aequidens</i>          | Teraglin                    | x          |
| SCORPAENIDAE      | <i>Centropogon australis</i>           | Eastern fortesque           | -          |
| SCORPAENIDAE      | <i>Notesthes robusta</i>               | Bullrout                    | -          |
| SCORPAENIDAE      | <i>Scorpaena cardinalis</i>            | Red rock cod                | x          |
| SCORPIDIDAE       | <i>Atypichthys strigatus</i>           | Mado                        | -          |
| SCORPIDIDAE       | <i>Microcanthus strigatus</i>          | Stripey                     | -          |

<sup>16</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

Table AB6 (cont)<sup>17</sup>.

| <b>Finfishes:</b>   |                                    |                      |   |
|---------------------|------------------------------------|----------------------|---|
| SERRANIDAE          | <i>Ellerkeldia mccullochi</i>      | Half-banded seaperch | - |
| SERRANIDAE          | <i>Epinephelus undulatostratus</i> | Maori cod            | - |
| SILLAGINIDAE        | <i>Sillago ciliata</i>             | Sand whiting         | x |
| SILLAGINIDAE        | <i>Sillago flindersi</i>           | Red spot whiting     | x |
| SILLAGINIDAE        | <i>Sillago maculata</i>            | Trumpeter whiting    | x |
| SILLAGINIDAE        | <i>Sillago robusta</i>             | Stout whiting        | x |
| SOLEIDAE            | <i>Synaptura nigra</i>             | Black sole           | - |
| SPARIDAE            | <i>Acanthopagrus australis</i>     | Bream                | x |
| SPARIDAE            | <i>Pagrus auratus</i>              | Snapper              | x |
| SPARIDAE            | <i>Rhabdosargus sarba</i>          | Tarwhine             | x |
| SPHYRAENIDAE        | <i>Sphyraena africana</i>          | Snook                | - |
| SPHYRAENIDAE        | <i>Sphyraena obtusata</i>          | Striped sea pike     | - |
| SYNODONTIDAE        | <i>Trachinocephalus myops</i>      | Painted grinner      | - |
| TERAPONTIDAE        | <i>Pelates quadrilineatus</i>      | Trumpeter            | - |
| TETRAODONTIDAE      | (assorted toadfish/pufferfish)     | Toadfish/pufferfish  | - |
| TRACHICHTHYIDAE     | <i>Optivus elongatus</i>           | Slender roughy       | - |
| TRACHICHTHYIDAE     | <i>Trachichthys australis</i>      | Pig faced roughy     | - |
| TRIGLIDAE           | <i>Chelidonichthys kumu</i>        | Red gurnard          | x |
| ZEIDAE              | <i>Zeus faber</i>                  | John dory            | x |
| (UNID. EELS)        | (unid. eels)                       | Eel                  | - |
| (UNID. PERCHLET)    | (unid. perchlet)                   | Unid. perchlet       | - |
| -                   | -                                  | Red barred grubfish  | - |
| <b>Crustaceans:</b> |                                    |                      |   |
| ALPHEIDAE           | <i>Alpheus</i> spp.                | Snapping shrimp      | - |
| GRAPSIDAE           | <i>Scylla serrata</i>              | Mud crab             | x |
| PAGURIDAE           | <i>Paguristes</i> spp.             | Hermit crab          | - |
| PALAEMONIDAE        | <i>Macrobrachium</i> sp.           | Long armed prawn     | - |
| PORTUNIDAE          | <i>Charybdis cruciata</i>          | Coral crab           | x |
| PORTUNIDAE          | <i>Ovalipes australiensis</i>      | 2 spot crab          | - |
| PORTUNIDAE          | <i>Portunus pelagicus</i>          | Blue swimmer crab    | x |
| PORTUNIDAE          | <i>Portunus sanguinolentus</i>     | 3 spot crab          | x |
| SCYLLARIDAE         | <i>Ibacus peronii</i>              | Balmain bug          | x |
| SQUILLIDAE          | <i>Squilla</i> sp.                 | Mantis shrimp        | - |
| (UNID. CRABS)       | (unid. crabs)                      | Crab                 | - |
| <b>Molluscs:</b>    |                                    |                      |   |
| LOLIGINIDAE         | <i>Loligo chinensis</i>            | Broad squid          | x |
| LOLIGINIDAE         | <i>Loligo</i> sp.                  | Slender squid        | x |
| LOLIGINIDAE         | <i>Loliolus</i> sp.                | Bottle squid         | x |
| LOLIGINIDAE         | <i>Sepioteuthis australis</i>      | Southern calamary    | x |
| OCTOPODA (ORDER)    | (unid. octopi)                     | Octopus              | x |
| SEPIIDAE            | <i>Sepia</i> sp.                   | Cuttlefish           | x |
| SEPIOLIDAE          | <i>Euprymna stenodactyla</i>       | Bubble squid         | - |
| SEPIOLIDAE          | <i>Sepioida lineolata</i>          | Candy stripe squid   | - |
| TEUTHOIDAE          | <i>Nototodarus gouldi</i>          | Arrow squid          | x |
| (UNID. NUDIBRANCH)  | (unid. nudibranch)                 | Nudibranch           | - |

<sup>17</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.

**Table AB7.** List of incidental taxa caught during observer based surveys of the Estuary Prawn Trawl Fleet in Botany Bay<sup>18</sup>.

| Family                       | Scientific name                    | Common name              | Commercial |
|------------------------------|------------------------------------|--------------------------|------------|
| <b>Finfishes:</b>            |                                    |                          |            |
| AMBASSIDAE                   | <i>Ambassis jacksoniensis</i>      | Port Jackson perchlet    | -          |
| AMBASSIDAE                   | <i>Ambassis marianus</i>           | Ramsey's perchlet        | -          |
| ANTENNARIIDAE                | <i>Antennarius striatus</i>        | Yellow anglerfish        | -          |
| APOGONIDAE                   | Apogon sp.                         | Cardinal fish            | -          |
| APOGONIDAE                   | <i>Gronovichtys atripes</i>        | Two-eyed cardinal fish   | -          |
| APOGONIDAE                   | <i>Siphamia roseigaster</i>        | Pink-breasted siphonfish | -          |
| ATHERINIDAE                  | <i>Pranesus ogilbyi</i>            | Ogilby's hardy head      | -          |
| BATRACHOIDIDAE               | <i>Batrachomoeus dubius</i>        | Eastern frogfish         | -          |
| BERYCIDAE                    | <i>Centroberyx affinis</i>         | Redfish                  | x          |
| BLENNIIDAE                   | <i>Petroscirtes lupus</i>          | Sabretooth blenny        | -          |
| BOTHIDAE                     | <i>Engyprosodon grandisquamma</i>  | Spiny-headed flounder    | -          |
| BOTHIDAE                     | <i>Pseudorhombus arsius</i>        | Large-toothed flounder   | x          |
| BOTHIDAE                     | <i>Pseudorhombus jenynsii</i>      | Small-toothed flounder   | x          |
| CALLIONYMIDAE                | (unid. stinkfish)                  | Stinkfish                | -          |
| CARANGIDAE                   | <i>Pseudocaranx dentex</i>         | Silver trevally          | x          |
| CARANGIDAE                   | <i>Seriola hippos</i>              | Samson fish              | x          |
| CARANGIDAE                   | <i>Trachurus novaezelandiae</i>    | Yellowtail               | x          |
| CENTROLOPHIDAE               | <i>Seriola brama</i>               | Warehou                  | x          |
| CHEILODACTYLIDAE             | <i>Cheilodactylus fuscus</i>       | Red morwong              | x          |
| CHEILODACTYLIDAE             | <i>Cheilodactylus vestitus</i>     | Magpie morwong           | x          |
| CLUPEIDAE                    | <i>Herklotsichthys castelnaui</i>  | Southern herring         | x          |
| CLUPEIDAE                    | <i>Hyperlophus vittatus</i>        | Sandy sprat              | x          |
| CONGRIDAE                    | <i>Conger wilsoni</i>              | Congor eel               | x          |
| CYNOGLOSSIDAE                | <i>Paraplagusia unicolor</i>       | Lemon tongue sole        | -          |
| DASYATIDIDAE/<br>UROLOPHIDAE | <i>Stingray/stingaree</i>          | Stingray/stingaree       | x          |
| DIDONTIDAE                   | <i>Dicotylichthys punctulatus</i>  | Porcupine fish           | -          |
| DINOLESTIDAE                 | <i>Dinolestes lewini</i>           | Long-finned pike         | -          |
| ECHENEIDIDAE                 | <i>Remora remora</i>               | Remora                   | -          |
| ENOPLOSIDAE                  | <i>Enoplosus armatus</i>           | Old wife                 | -          |
| FISTULARIIDAE                | <i>Fistularia</i> spp.             | Flutemouth               | -          |
| GEMPYLIDAE                   | <i>Thyristes atun</i>              | Barracouta               | x          |
| GERREIDAE                    | <i>Gerres subfasciatus</i>         | Common silver biddy      | x          |
| GIRELLIDAE                   | <i>Girella tricuspidata</i>        | Blackfish                | x          |
| GOBIIDAE                     | <i>Arenigobius bifrenatus</i>      | Bridled goby             | -          |
| GOBIIDAE                     | <i>Favonigobius exquisitus</i>     | Exquisite goby           | -          |
| GOBIIDAE                     | <i>Favonigobius tamarensis</i>     | Tamar river goby         | -          |
| GOBIIDAE                     | <i>Favonigobius lateralis</i>      | Long finned goby         | -          |
| GOBIIDAE                     | <i>Tridentiger trigonocephalus</i> | Japanese goby            | -          |

<sup>18</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.



Table AB7 (cont)<sup>19</sup>.

| Family            | Scientific name                      | Common name                 | Commercial |
|-------------------|--------------------------------------|-----------------------------|------------|
| <b>Finfishes:</b> |                                      |                             |            |
| GONORYNCHIDAE     | <i>Gonorynchus greyi</i>             | Beaked salmon               | -          |
| HEMIRAMPHIDAE     | <i>Hyporhamphus australis</i>        | Eastern sea garfish         | x          |
| HETERODONTIDAE    | <i>Heterodontos portjacksoni</i>     | Port jackson shark          | -          |
| LABRIDAE          | <i>Achoerodus viridis</i>            | Eastern blue groper         | -          |
| LEIOGNATHIDAE     | <i>Leignathus</i> sp.                | Pony fish                   | -          |
| LETHRINIDAE       | <i>Lethrinus nebulosis</i>           | Spangled emperor            | x          |
| MONACANTHIDAE     | (unid. leatherjackets)               | Unid. leatherjacket         | x          |
| MONACANTHIDAE     | <i>Acanthaluteres spilomelanurus</i> | Bridled leatherjacket       | x          |
| MONACANTHIDAE     | <i>Brachaluteres jacksonianus</i>    | Pygmy leatherjacket         | x          |
| MONACANTHIDAE     | <i>Eubalichthys mosaicus</i>         | Mosaic leatherjacket        | x          |
| MONACANTHIDAE     | <i>Meuschenia australis</i>          | Brown-striped leatherjacket | x          |
| MONACANTHIDAE     | <i>Meuschenia freycineti</i>         | Six-spined leatherjacket    | x          |
| MONACANTHIDAE     | <i>Meuschenia trachylepis</i>        | Yellowfin leatherjacket     | x          |
| MONACANTHIDAE     | <i>Monacanthus chinensis</i>         | Fanbellied leatherjacket    | x          |
| MONACANTHIDAE     | <i>Nelusetta ayraudi</i>             | Chinaman leatherjacket      | x          |
| MONACANTHIDAE     | <i>Paramonacanthus otisensis</i>     | Dusky leatherjacket         | x          |
| MONACANTHIDAE     | <i>Parika scaber</i>                 | Velvet leatherjacket        | x          |
| MONACANTHIDAE     | <i>Scobinichthys granulatus</i>      | Rough skin leatherjacket    | x          |
| MORIDAE           | <i>Pseudophycis breviusculus</i>     | Bearded cod                 | -          |
| MUGILIDAE         | <i>Mugil cephalus</i>                | Sea mullet                  | x          |
| MUGILIDAE         | <i>Myxus elongatus</i>               | Sand mullet                 | x          |
| MULLIDAE          | (unid. goatfish)                     | Goatfish                    | x          |
| MULLIDAE          | <i>Parupeneus signatus</i>           | Blackspot goatfish          | -          |
| MULLIDAE          | <i>Upeneichthys lineates</i>         | Red mullet                  | x          |
| MULLIDAE          | <i>Upeneus tragula</i>               | Bar-tailed goatfish         | x          |
| MYLIOBATIDAE      | <i>Myliobatis australis</i>          | Eagle ray                   | -          |
| OPHIDIIDAE        | <i>Genypterus tigerinus</i>          | Rock ling                   | -          |
| OPICHTHIDAE       | <i>Ophisurus serpens</i>             | Serpent eel                 | -          |
| OSTRACIIDAE       | (unid. boxfish)                      | Boxfish                     | -          |
| OSTRACIIDAE       | <i>Lactoria</i> spp                  | Cowfish                     | -          |
| OSTRACIIDAE       | <i>Tetrosomus reipublicae</i>        | Turret fish                 | -          |
| PEGASIDAE         | <i>Parapegasus natans</i>            | Slender sea moth            | -          |
| PEMPHERIDIDAE     | <i>Pempheris compressa</i>           | Deep bullseye               | -          |
| PEMPHERIDIDAE     | <i>Pempheris multiradiatus</i>       | Common bullseye             | -          |
| PENTACEROTIDAE    | <i>Paristiopterus labiosis</i>       | Giant boar fish             | x          |
| PENTACEROTIDAE    | <i>Pentaceropsis recurvirostris</i>  | Long-snouted boarfish       | x          |

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Table AB7 (cont)<sup>20</sup>.

| Family            | Scientific name                        | Common name                | Commercial |
|-------------------|----------------------------------------|----------------------------|------------|
| <b>Finfishes:</b> |                                        |                            |            |
| PLATYCEPHALIDAE   | <i>Platycephalus arenarius</i>         | Northern sand flathead     | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus caeruleopunctatus</i> | Eastern blue spot flathead | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus fuscus</i>            | Dusky flathead             | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus longispinus</i>       | Long spined flathead       | -          |
| PLATYCEPHALIDAE   | <i>Platycephalus marmoratus</i>        | Marble flathead            | x          |
| PLATYCEPHALIDAE   | <i>Platycephalus richardsoni</i>       | Tiger flathead             | x          |
| PLATYCEPHALIDAE   | <i>Ratabulus diversidens</i>           | Spikey flathead            | x          |
| PLATYCEPHALIDAE   | <i>Suggrundus jugosis</i>              | Mud flathead               | x          |
| PLEURONECTIDAE    | <i>Ammotretis rostratus</i>            | Long snouted flounder      | -          |
| PLEURONECTIDAE    | <i>Rhombosolea tapirina</i>            | Greenback flounder         | x          |
| PLOTOSIDAE        | <i>Euristhmus lepturus</i>             | Long-tailed catfish        | -          |
| PLOTOSIDAE        | <i>Plotosis lineatus</i>               | Striped catfish            | -          |
| POMATOMIDAE       | <i>Pomatomus saltatrix</i>             | Tailor                     | x          |
| PRIACANTHIDAE     | <i>Priacanthus macracanthus</i>        | Red bigeye                 | -          |
| PSYCHROLUTIDAE    | <i>Psychrolutes marcidus</i>           | Blob fish                  | -          |
| RAJIDAE           | <i>Raja</i> spp.                       | Skate                      | x          |
| RHINOBATIDAE      | <i>Aptychotrema rostrata</i>           | Shovelnose ray             | x          |
| RHINOBATIDAE      | <i>Trygonorrhina</i> sp.               | Banjo ray                  | x          |
| SCARIDAE          | (unid. parrotfish)                     | Parrot fish                | x          |
| SCARIDAE          | <i>Scarus sordidus</i>                 | Green-finned parrot fish   | -          |
| SCATOPHAGIDAE     | <i>Selenotoca multifasciata</i>        | Old maid                   | -          |
| SCIAENIDAE        | <i>Argyrosomus japonicus</i>           | Jewfish                    | x          |
| SCOMBRIDAE        | <i>Scomber australasicus</i>           | Blue mackerel              | x          |
| SCORPAENIDAE      | <i>Centropogon australis</i>           | Eastern fortesque          | -          |
| SCORPAENIDAE      | <i>Notesthes robusta</i>               | Bullrout                   | -          |
| SCORPAENIDAE      | <i>Pterois volitans</i>                | Red firefish               | -          |
| SCORPAENIDAE      | <i>Scorpaena cardinalis</i>            | Red rock cod               | x          |
| SCORPIDIDAE       | <i>Atypichthys strigatus</i>           | Mado                       | -          |
| SCORPIDIDAE       | <i>Microcanthus strigatus</i>          | Stripey                    | -          |
| SERRANIDAE        | <i>Callanthias allporti</i>            | Splendid perch             | -          |
| SERRANIDAE        | <i>Epinephelus septemfasciatus</i>     | Bar cod                    | x          |
| SIGANIDAE         | <i>Siganus fuscescens</i>              | Black spinefoot            | -          |
| SILLAGINIDAE      | <i>Sillago ciliata</i>                 | Sand whiting               | x          |
| SILLAGINIDAE      | <i>Sillago flindersi</i>               | Red spot whiting           | x          |
| SILLAGINIDAE      | <i>Sillago maculata</i>                | Trumpeter whiting          | x          |
| SILLAGINIDAE      | <i>Sillago robusta</i>                 | Stout whiting              | x          |
| SOLEIDAE          | <i>Pardachirus hedleyi</i>             | Peacock sole               | -          |
| SOLEIDAE          | <i>Synaptura nigra</i>                 | Black sole                 | -          |
| SOLEIDAE          | <i>Synclidopus macleanus</i>           | Narrow banded sole         | -          |
| SPARIDAE          | <i>Acanthopagrus australis</i>         | Bream                      | x          |
| SPARIDAE          | <i>Pagrus auratus</i>                  | Snapper                    | x          |
| SPARIDAE          | <i>Rhabdosargus sarba</i>              | Tarwhine                   | x          |
| SPHYRAENIDAE      | <i>Sphyraena africana</i>              | Snook                      | -          |
| SPHYRAENIDAE      | <i>Sphyraena obtusata</i>              | Striped sea pike           | -          |

<sup>20</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.



Table AB7 (cont)<sup>21</sup>.

| Family              | Scientific name                 | Common name          | Commercial |
|---------------------|---------------------------------|----------------------|------------|
| <b>Finfishes:</b>   |                                 |                      |            |
| SYNGNATHIDAE        | (unid. pipefish)                | Pipefish             | -          |
| SYNGNATHIDAE        | Hippocampus spp.                | Seahorse             | -          |
| SYNODONTIDAE        | <i>Trachinocephalus myops</i>   | Painted grinner      | -          |
| TERAPONTIDAE        | <i>Pelates quadrilineatus</i>   | Trumpeter            | x          |
| TETRAODONTIDAE      | (assorted toadfish/pufferfish)  | Toadfish/pufferfish  | -          |
| TRACHICHTHYIDAE     | <i>Optivus elongatus</i>        | Slender roughy       | -          |
| TRIGLIDAE           | (unid. gurnard)                 | Unid. gurnard        | x          |
| TRIGLIDAE           | <i>Chelidonichthys kumu</i>     | Red gurnard          | x          |
| TRIGLIDAE           | <i>Pterygotrigla polyommata</i> | Sharp-beaked gurnard | x          |
| URANOSCOPIDAE       | <i>Ichthyoscopus lebeck</i>     | Spotted stargazer    | x          |
| ZEIDAE              | <i>Zeus faber</i>               | John dory            | x          |
| (UNID. EELS)        | (unid. eels)                    | Eel                  | x          |
| (UNID. PERCHLET)    | (unid. perchlet)                | Unid. perchlet       | -          |
| <b>Crustaceans:</b> |                                 |                      |            |
| ALPHEIDAE           | <i>Alpheus</i> spp.             | Snapping shrimp      | -          |
| PAGURIDAE           | <i>Paguristes</i> spp.          | Hermit crab          | x          |
| PALINURIDAE         | <i>Jasus lalandii</i>           | Southern cray        | x          |
| PALINURIDAE         | <i>Jasus verreauxi</i>          | Eastern cray         | x          |
| PORTUNIDAE          | <i>Charybdis cruciata</i>       | Coral crab           | x          |
| PORTUNIDAE          | <i>Ovalipes australiensis</i>   | 2 spot crab          | x          |
| PORTUNIDAE          | <i>Portunus pelagicus</i>       | Blue swimmer crab    | x          |
| PORTUNIDAE          | <i>Portunus sanguinolentus</i>  | 3 spot crab          | x          |
| (UNID. CRABS)       | (unid. crabs)                   | Crab                 | x          |
| SCYLLARIDAE         | <i>Ibacus peronii</i>           | Balmain bug          | x          |
| SQUILLIDAE          | <i>Squilla</i> sp.              | Mantis shrimp        | x          |
| <b>Molluscs:</b>    |                                 |                      |            |
| LOLIGINIDAE         | <i>Loligo chinensis</i>         | Broad squid          | x          |
| LOLIGINIDAE         | <i>Loligo</i> sp.               | Slender squid        | x          |
| LOLIGINIDAE         | <i>Loliolus</i> sp.             | Bottle squid         | x          |
| LOLIGINIDAE         | <i>Sepioteuthis australis</i>   | Southern calamary    | x          |
| OCTOPODA (ORDER)    | (unid. octopi)                  | Octopus              | x          |
| OCTOPODA (ORDER)    | <i>Hapaloachaena maculosa</i>   | Blue ringed octopus  | -          |
| PECTINIDAE          | <i>Pecten fumatus</i>           | Tasmanian scallop    | x          |
| SEPIIDAE            | <i>Sepia</i> sp.                | Cuttlefish           | x          |
| SEPIOLIDAE          | <i>Euprymna stenodactyla</i>    | Bubble squid         | x          |
| SEPIOLIDAE          | <i>Sepioloidea lineolata</i>    | Candy stripe squid   | x          |
| TEUTHOIDAE          | <i>Nototodarus gouldi</i>       | Arrow squid          | x          |
| (UNID. SQUID)       | (unid. squid)                   | Unid. squid          | x          |
| <b>Echinoderms:</b> |                                 |                      |            |
| (UNID. STARFISH)    | (unid. starfish)                | Starfish             | -          |

<sup>21</sup> Note: Since this study was completed clause 34 (3) (b) of the Fisheries Management (General) Regulations (see Appendix B3) has been amended to prohibit the commercial take of any species listed as a prohibited size fish in the table to clause 7 of the Fisheries Management (General) Regulations. Fishers may retain any of the invertebrates listed in part 2 of the table except lobsters and abalone.



## APPENDIX B2. LANDINGS OF SPECIES BY THE ESTUARY PRAWN TRAWL FISHERY

**Table AB8.** Species composition and average weight (kg) of annual reported landings ('97-'98 and '98-'99) for the Estuary Prawn Trawl Fishery.

| Species Name               | Clarence River | Hunter River | Hawkesbury River | Port Jackson | Botany Bay |
|----------------------------|----------------|--------------|------------------|--------------|------------|
| Bonito                     | 0              | 0            | 1                | 0            | 0          |
| Bullseye, red              | 0              | 0            | 5.5              | 0            | 0          |
| Calamari, southern         | 0              | 0.5          | 0                | 2.5          | 26         |
| Catfish, estuary           | 309            | 1.5          | 458.5            | 45.5         | 0          |
| Catfish, forktailed        | 32             | 0            | 0                | 0            | 0          |
| Catfish, Unspecified       | 177            | 0            | 39               | 0            | 0          |
| Cockle                     | 2              | 0            | 0                | 0            | 68.5       |
| Crab, blue swimmer         | 16             | 0            | 3830.5           | 577          | 1356.5     |
| Crab, coral                | 0              | 0            | 10.5             | 0            | 0          |
| Crab, mud                  | 498.5          | 0            | 26               | 4            | 0          |
| Crab, sand                 | 0              | 0            | 0                | 0            | 12         |
| Crab, unspecified          | 0              | 0            | 0                | 2            | 0          |
| Cuttlefish                 | 0              | 0            | 5                | 154.5        | 0          |
| Dory, john                 | 0              | 0            | 0.5              | 46           | 0          |
| Eel, conger                | 11             | 0            | 0                | 0            | 0          |
| Eel, longfin river         | 270.5          | 0            | 12.5             | 0            | 0          |
| Eel, pike                  | 0.5            | 0            | 3.5              | 0            | 0          |
| Eel, shortfin river        | 125.5          | 0            | 24               | 4            | 0          |
| Eel, unspecified           | 2              | 0            | 15.5             | 0            | 0          |
| Fish, unspecified estuary  | 0              | 0            | 2424             | 715.5        | 370        |
| Fish, unspeci. ocean       | 0              | 0            | 219              | 7.5          | 0          |
| Flounder, unspecified      | 1.5            | 0            | 1384             | 220          | 102.5      |
| Garfish, river             | 30             | 0            | 0                | 0            | 0          |
| Garfish, sea               | 7.5            | 0            | 0                | 0            | 0          |
| Garfish, shortbill         | 39             | 0            | 0                | 0            | 0          |
| Hairtail                   | 0              | 0            | 327              | 0            | 0          |
| Leatherjacket, unspecified | 0              | 0            | 0                | 0            | 20         |
| Longtom                    | 9.5            | 0            | 0                | 0            | 0          |
| Mackerel, blue             | 0              | 0            | 11               | 0            | 0          |
| Mackerel, spotted          | 0              | 0            | 8                | 0            | 0          |
| Mado                       | 0              | 0            | 0                | 58           | 0          |
| Mullet, fantail            | 15             | 0            | 52.5             | 0            | 0          |
| Mullet, sand               | 19.5           | 49           | 0                | 0            | 0          |
| Mulloyay                   | 102            | 0            | 31               | 0            | 0          |
| Octopus                    | 5              | 0            | 180.5            | 91           | 13673      |
| Old maid                   | 175.5          | 0            | 6.5              | 0            | 421.5      |
| Pike                       | 0              | 0            | 4                | 0            | 0          |
| Pilchard                   | 6              | 0            | 1201.5           | 0            | 0          |

Table AB8 (cont).

| Species Name           | Clarence River | Hunter River | Hawkesbury River | Port Jackson | Botany Bay   |
|------------------------|----------------|--------------|------------------|--------------|--------------|
| Pipi                   | 0              | 0            | 0                | 0            | 35.5         |
| Prawn, eastern king    | 3859.5         | 1223.5       | 2622             | 3406         | 8838.5       |
| Prawn, greasyback      | 54             | 56.5         | 51.5             | 191          | 526          |
| Prawn, school          | 258573         | 49942        | 52881            | 474          | 5773.5       |
| Prawn, tiger           | 245.5          | 0            | 20               | 36.5         | 0            |
| Sandy sprat            | 0              | 0            | 129.5            | 0            | 32           |
| Scallop                | 231            | 0            | 0                | 30.5         | 335          |
| Shark, black tip       | 210.5          | 0            | 0                | 0            | 0            |
| Shark, blue whaler     | 0              | 0            | 3                | 0            | 0            |
| Shark, carpet          | 0              | 0            | 28               | 0            | 0            |
| Shark, fiddler         | 0              | 0            | 187              | 3.5          | 0            |
| Shark, hammerhead      | 0              | 0            | 31               | 0            | 0            |
| Shark, school          | 0              | 0            | 24               | 0            | 0            |
| Shark, shovelnose      | 0              | 0            | 14               | 7.5          | 0            |
| Shrimp, mantis         | 0              | 0            | 40.5             | 103          | 0            |
| Silver biddy           | 114            | 0            | 5269.5           | 215          | 71           |
| Sole, black            | 0              | 0            | 54.5             | 0            | 0            |
| Sole, mixed            | 0              | 0            | 15.5             | 0            | 0            |
| Spanner crab           | 0              | 0            | 2.5              | 0            | 0            |
| Squid                  | 15.5           | 2.5          | 46286            | 213          | 0            |
| Squid, arrow           | 7              | 0            | 0                | 0            | 0            |
| Stingray               | 0              | 0            | 10               | 0            | 0            |
| Tailor                 | 1              | 0            | 184.5            | 0            | 0            |
| Tarwhine               | 0              | 0            | 0                | 0            | 25           |
| Trevally, silver       | 4.5            | 0            | 372.5            | 0            | 169          |
| Trumpeter              | 0              | 0            | 16               | 206.5        | 0            |
| Trumpeter, unspecified | 0              | 0            | 0                | 15           | 0            |
| Whitebait (glass fish) | 0              | 0            | 199              | 0            | 57           |
| Whiting, school        | 0              | 0            | 10.5             | 0            | 0            |
| Whiting, trumpeter     | 14.5           | 0            | 11657            | 2794.5       | 822.5        |
| Yellowtail             | 0              | 0            | 1595             | 0            | 0            |
| <b>GRAND TOTAL</b>     | <b>261940</b>  | <b>51436</b> | <b>133245</b>    | <b>9719</b>  | <b>33807</b> |

## APPENDIX B3. NET REGULATIONS

### 34. Commercial Otter Trawl Net (prawns)

- (1) It is lawful to use an otter trawl net for taking prawns in the waters specified in the Table to this clause if the net complies with the description as set out in relation to those waters in that Table and the following conditions are complied with:
  - (a) The net is used only by the method of trawling
  - (b) Not more than two nets are used at any one time in the Hawkesbury River (downstream from a line drawn between Juno Point and Eleanor Bluff), Clarence River, Botany Bay, Port Jackson, Jervis Bay or Coffs Harbour
  - (c) Not more than one net is used at any one time in the Hunter River or in the Hawkesbury River upstream from a line drawn between Juno Point and Eleanor Bluff to the ferry crossing at Lower Portland
  - (d) No string, rope, wire, cord, netting or other material is fixed to any meshes that are within 25 meshes of the draw or closing string of the cod-end of the net.
- (2) Despite Sub-Clause (1)(d), an otter trawl net may have attached to it any of the following:
  - (a) a draw or closing string at the end of the cod-end
  - (b) a frill of netting material, if the frill is not attached more than five meshes from the last row of meshes of the cod-end
  - (c) a chafing piece, in accordance with Clause 55(2).
- (3) It is lawful to use an otter trawl net to take other fish when it is being lawfully used for taking prawns if:
  - (a) the fish are not a prohibited size class of fish and are not of a species the taking of which is prohibited or
  - (b) the fish are a prohibited size class of fish (other than abalone or crustaceans), are not of a prohibited size and are taken in waters north of a line drawn due east from the lighthouse situated at Smoky Cape (excluding inland waters, the Clarence River and Lake Woollooweyah) or
  - (c) the fish are a prohibited size class of fish (being crustaceans other than rock lobster) and are not of a prohibited size.
- (4) For the purposes of this Regulation or any other instrument under the *FM Act*, a net described in this clause may be referred to as an otter trawl net (prawns).

Otter trawl net (prawns).

- 1 (a) Waters - All waters (other than inland waters, the Clarence River and Lake Wooloweyah).
  - (b) Description of net. Total length not exceeding 11 metres (except in respect of a net used in ocean waters, in which case the total length of the net is not to exceed 33 metres or, if a maximum length for otter trawl nets (prawns) is specified in the boat licence for the boat from which the net is used, the length so specified); mesh of cod-end (or portion of the net capable of being used as a cod-end) not less than 40 mm nor more than 50 mm; mesh of net (other than cod-end or the portion of the net capable of being used as a cod-end) not less than 40 mm nor more than 60 mm; length of sweep attached to net (being the distance between the point of attachment to the otter boards and the net) not exceeding five metres or the distance from the trawl gallows to the stern of the boat (whichever is the greater); sweep to be secured to the net and the otter board so that it cannot exceed five metres in length or the distance from the trawl gallows to the stern of the boat (whichever is the greater).
- 2 (a) Waters-Clarence River and Lake Wooloweyah.
  - (b) Description of net - Total length of net (when towed as single gear) not exceeding 11 metres, total length of either net (when towed as twin gear) not exceeding 7.5 metres; mesh of cod-end (or portion of the net capable of being used as a cod-end) not less than 40 mm nor more than 50 mm; mesh of net (other than cod-end or the portion of the net capable of being used as a cod-end) not less than 40 mm nor more than 60 mm; length of sweep attached to net (being the distance between the point of attachment to the otter boards and the net) not exceeding five metres or the distance from the trawl gallows to the stern of the boat (whichever is the greater); sweep to be secured to the net and the otter board so that it cannot exceed five metres in length or the distance from the trawl gallows to the stern of the boat (whichever is the greater).

## **48. Hand-hauled prawn net**

- (1) It is lawful to use a hand-hauled net for taking prawns in the waters specified in the Table to this clause if the net complies with the description as set out in relation to those waters in that Table and the following conditions are complied with:
  - (a) The net is not staked or set, or joined or placed together with any other net
  - (b) The net is continuously and manually propelled and not used as a stationary net
  - (c) The net is not attached to a hauling line.
- (2) It is also lawful to use a hand-hauled net to take other fish (other than a prohibited size class of fish) that are taken by the net when it is being lawfully used for taking prawns.
- (3) For the purposes of this Regulation or any other instrument under the Act, a net described in this clause may be referred to as a hand-hauled prawn net.

Hand-hauled prawn net.

- (a) Waters - Any waters (other than inland waters).
- (b) Description of net - Total length not exceeding six metres; mesh throughout not less than 30 mm nor more than 36 mm.

#### **49. Push or scissors net (prawns)**

- (1) It is lawful to use a push or scissors net for taking prawns in the waters specified in the Table to this clause if the net complies with the description as set out in relation to those waters in that Table and the following conditions are complied with:
  - (a) The net is used only as a hand implement and is not staked or set, or joined or placed together with any other net
  - (b) The net is continuously propelled and not used as a stationary net
  - (c) The net is operated only by 1 person without assistance from any other person
  - (d) Only 1 net is used by a person at any one time.
- (2) It is also lawful to use a push or scissors net to take other fish (other than a prohibited size class of fish) that are taken by the net when it is being lawfully used for taking prawns.
- (3) For the purposes of this Regulation or any other instrument under the Act, a net described in this clause may be referred to as a push or scissors net (prawns).

Push or scissors net (prawns).

- (a) Waters - Any waters (other than inland waters).
- (b) Description of net - Net attached to a scissors-type frame; length of lead or bottom line between the lower extremities of the poles not exceeding 2.75 metres; mesh not less than 30 mm nor more than 36 mm.

#### **50. Dip or scoop net (prawns)**

- (1) It is lawful to use a dip or scoop net for taking prawns in the waters specified in the Table to this clause if the net complies with the description as set out in relation to those waters in that Table and the following conditions are complied with:
  - (a) The net is used as a hand implement only and not staked or set, or joined or placed together with any other net
  - (b) Only 1 net is used by a person at any one time.
- (2) It is also lawful to use a dip or scoop net to take other fish that are taken by the net when it is being lawfully used for taking prawns.
- (3) For the purposes of this Regulation or any other instrument under the Act, a net described in this clause may be referred to as a dip or scoop net (prawns).

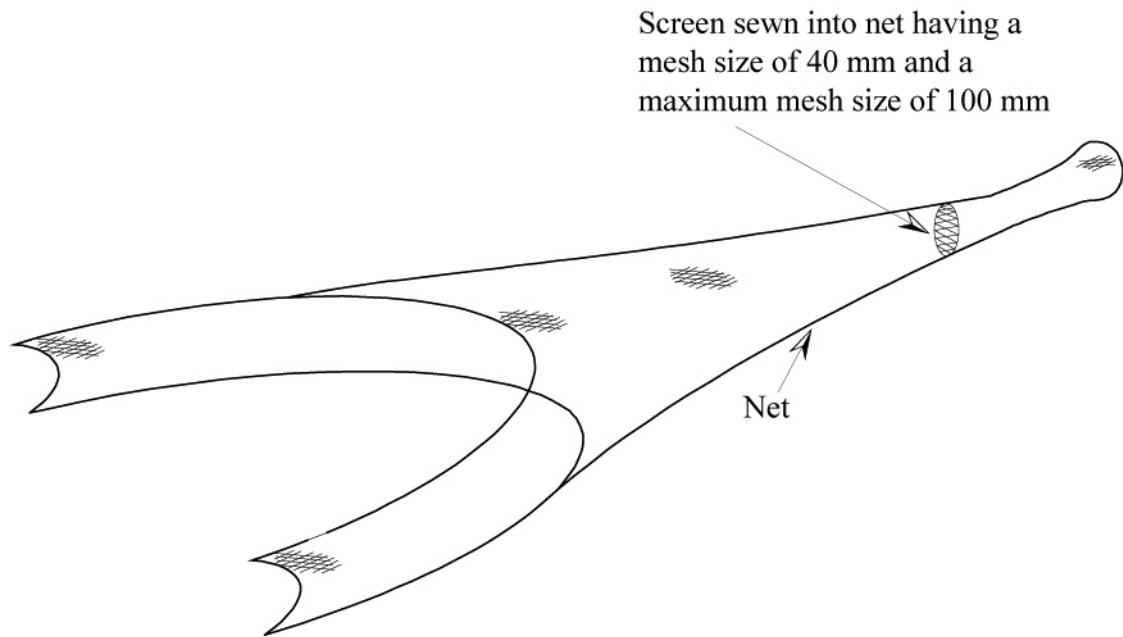
Dip or scoop net (prawns).

- (a) Waters - Any waters (other than inland waters).
- (b) Description of net - Net attached to a frame, hoop or ring not exceeding 0.6 metre in its greatest diameter, with a handle of not more than 1.2 metres in length, with a total length from the centre of the plane of the frame, hoop or ring to the extremity of the net not exceeding 1.25 metres; mesh not less than 20 mm.

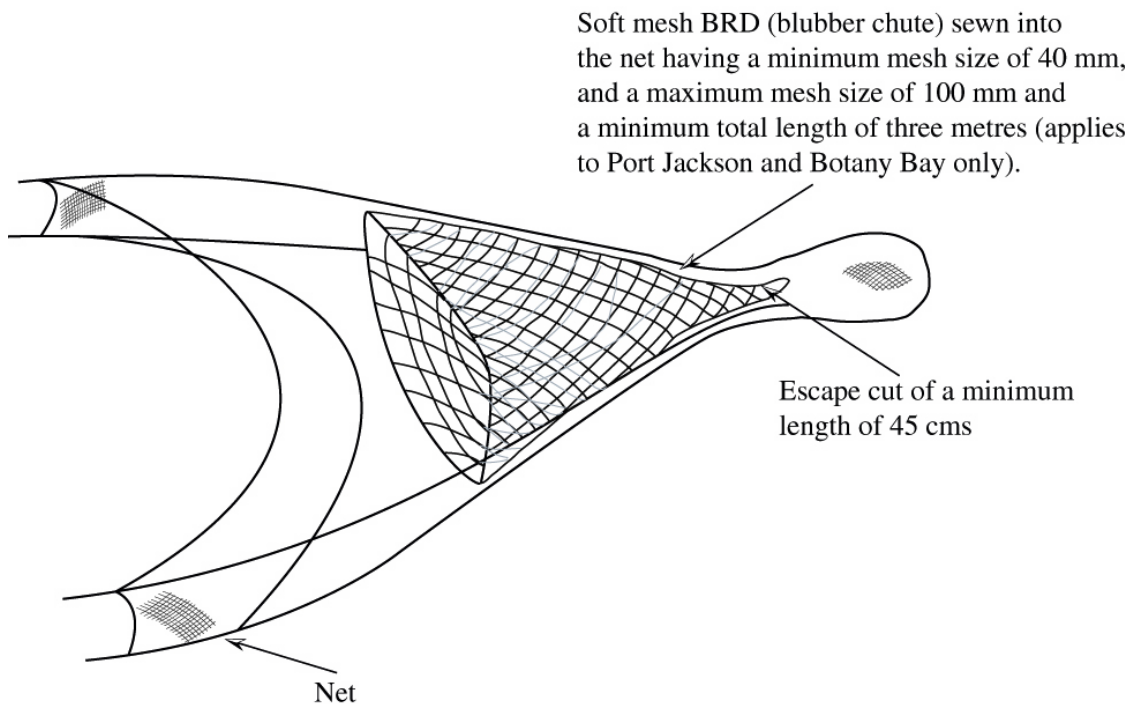


## APPENDIX B4

### DESCRIPTIONS OF BYCATCH REDUCTION DEVICES

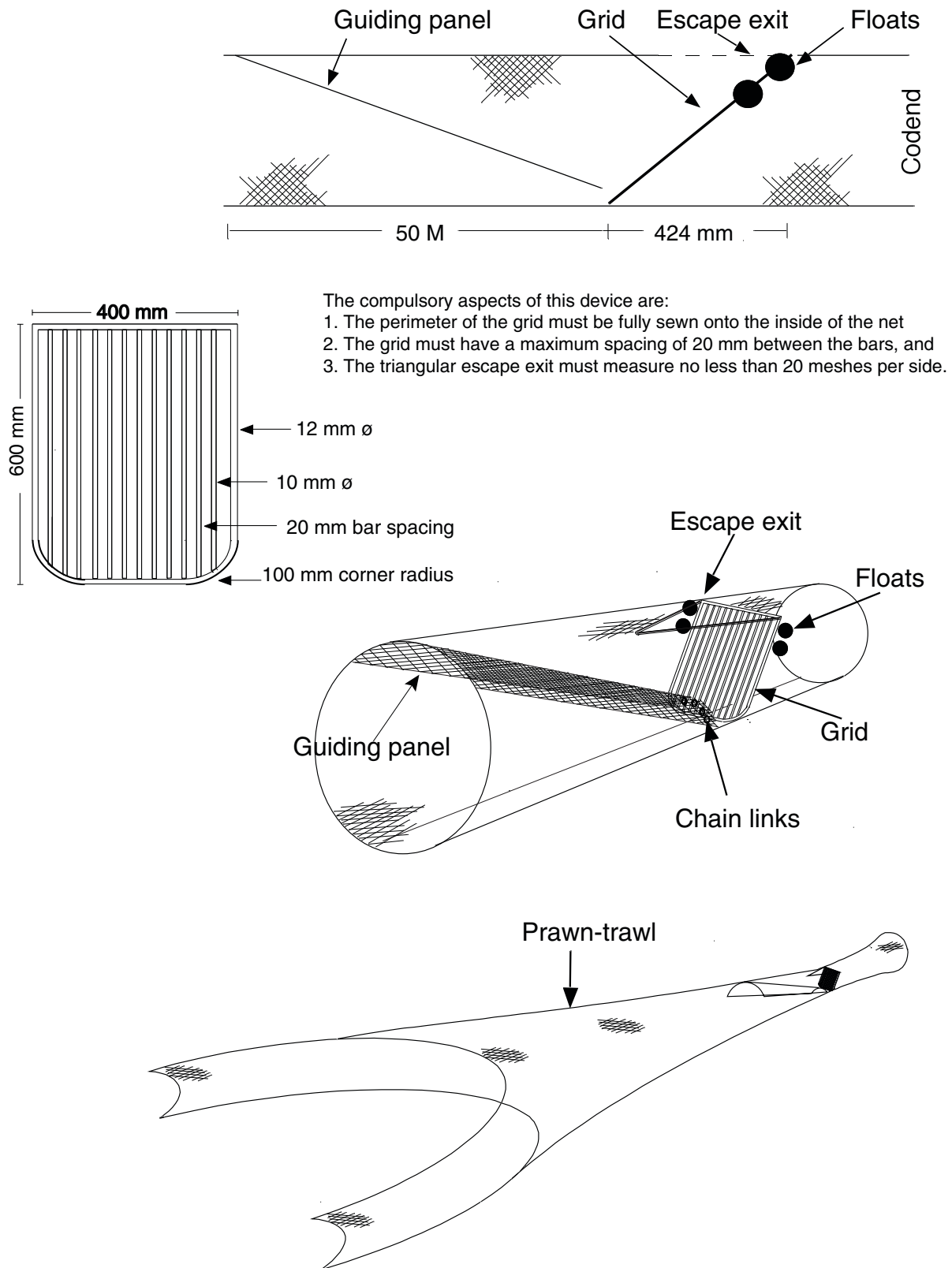


**Figure AB1.** Port Jackson Screen

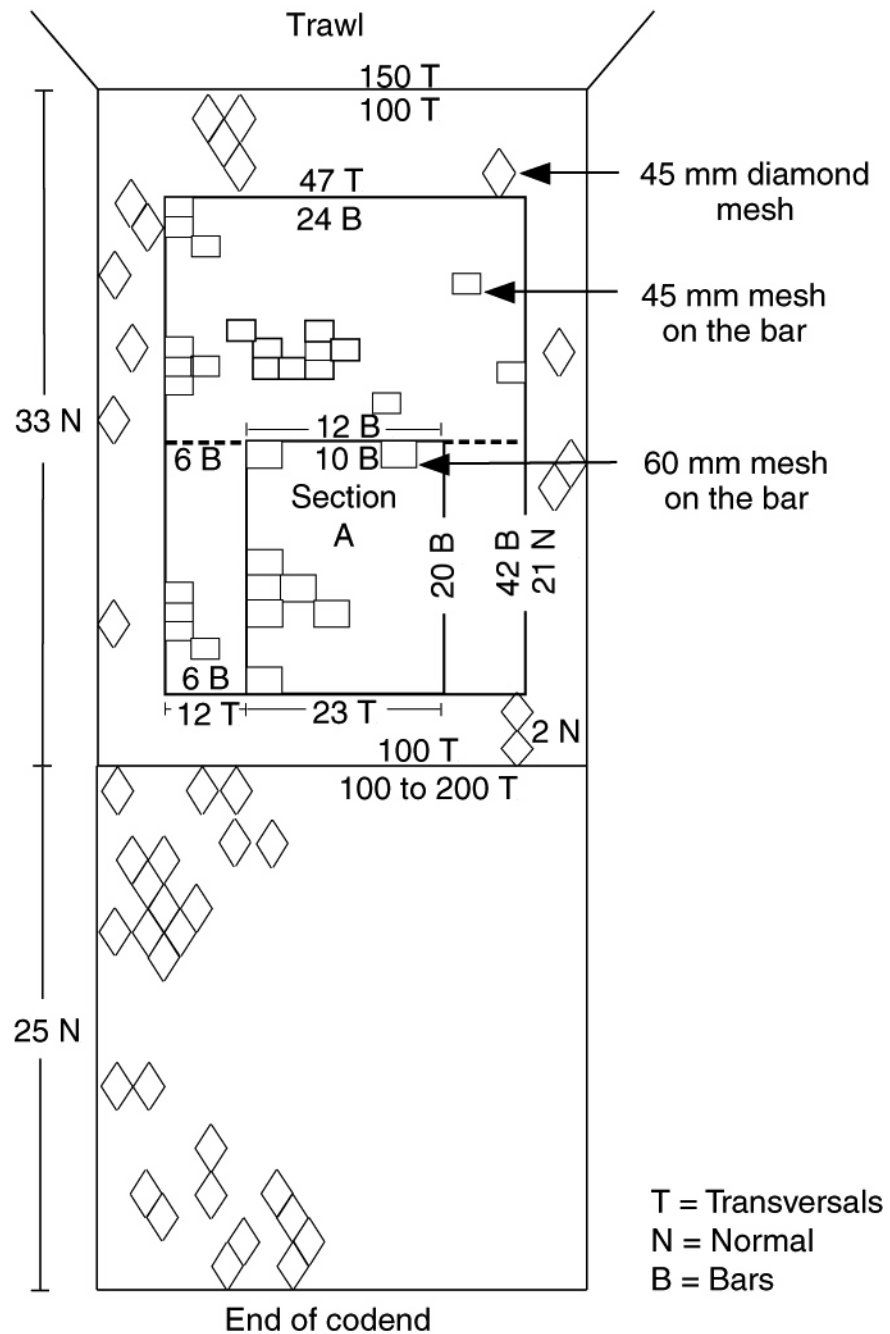


**Figure AB2.** Softmesh BRD (blubber chute)

**Note:** Hawkesbury River has a maximum mesh size of 175 mm.)



**Figure AB3.** Nordemore Grid



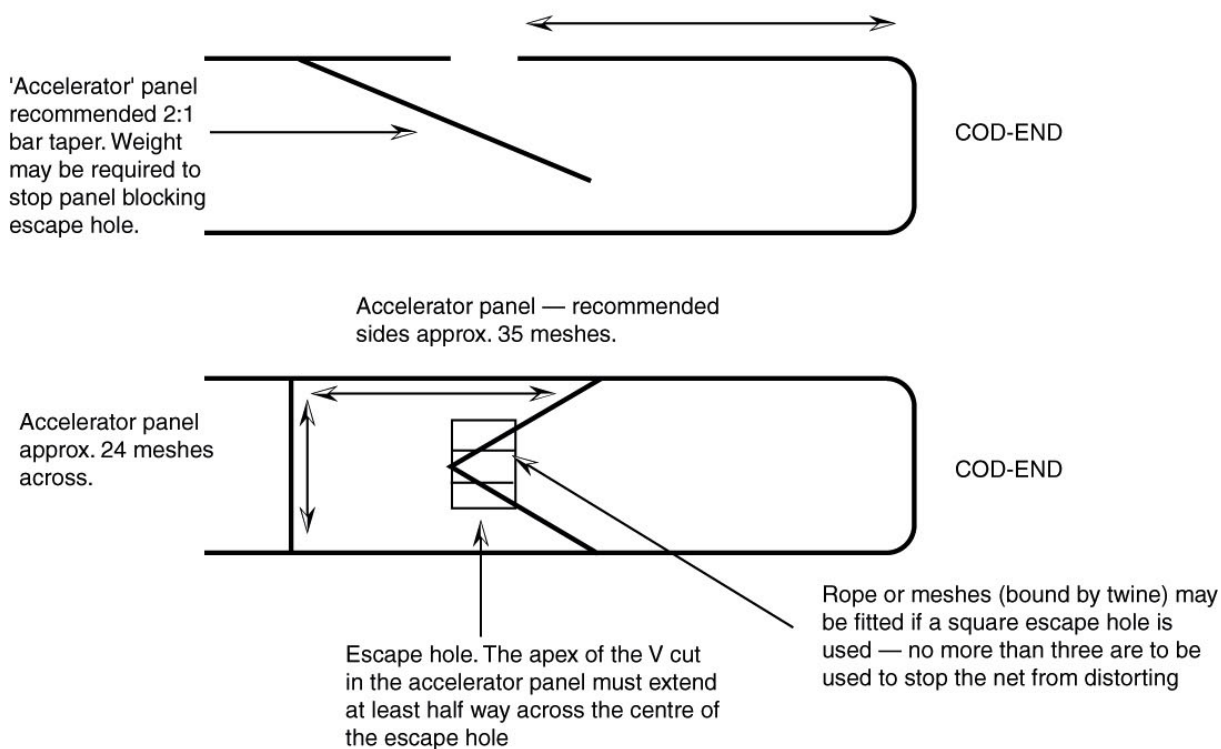
The compulsory aspects of this device are:

1. The panel is sewn into the top of the codend, with its base a maximum length of 1.2 m from the drawstring of 37 meshes
2. The dimensions of the main square mesh panel (section A) must be a minimum of 60 cm by 30 cm wide

**Figure AB4.** Square Mesh Panel

## The 'Quality Clarence Panel' BRD

The base of the escape hole must be within 1.2 m of the cod-end drawstring.



The escape hole may be either a square or a diamond shape.

If using a square escape hole, the hole must be a minimum of 15 meshes across and a minimum of 5 meshes up the net.

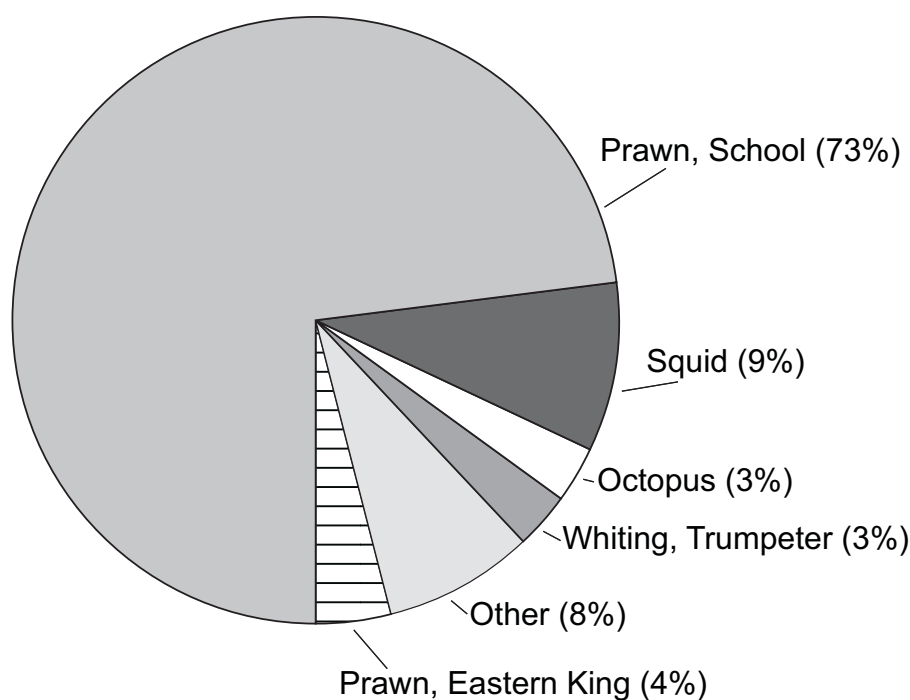
If using a diamond shaped escape hole, each side of the diamond must be at least 10 bars long. It is recommended that the diamond is cut out of a separate panel of net (approx. 15 meshes across and 11 meshes long) that is then sewn into the net. It is also recommended that 2 points on the net are sewn to each point on the panel to prevent the escape hole from closing.

A rigid frame may be fitted around the escape hole (i.e. diamond or square).

**Figure AB5.** Quality Clarence Panel BRD

## APPENDIX B5. CATCH INFORMATION FOR THE TARGET AND BYPRODUCT SPECIES IN EACH ESTUARY OF THE ESTUARY PRAWN TRAWL FISHERY

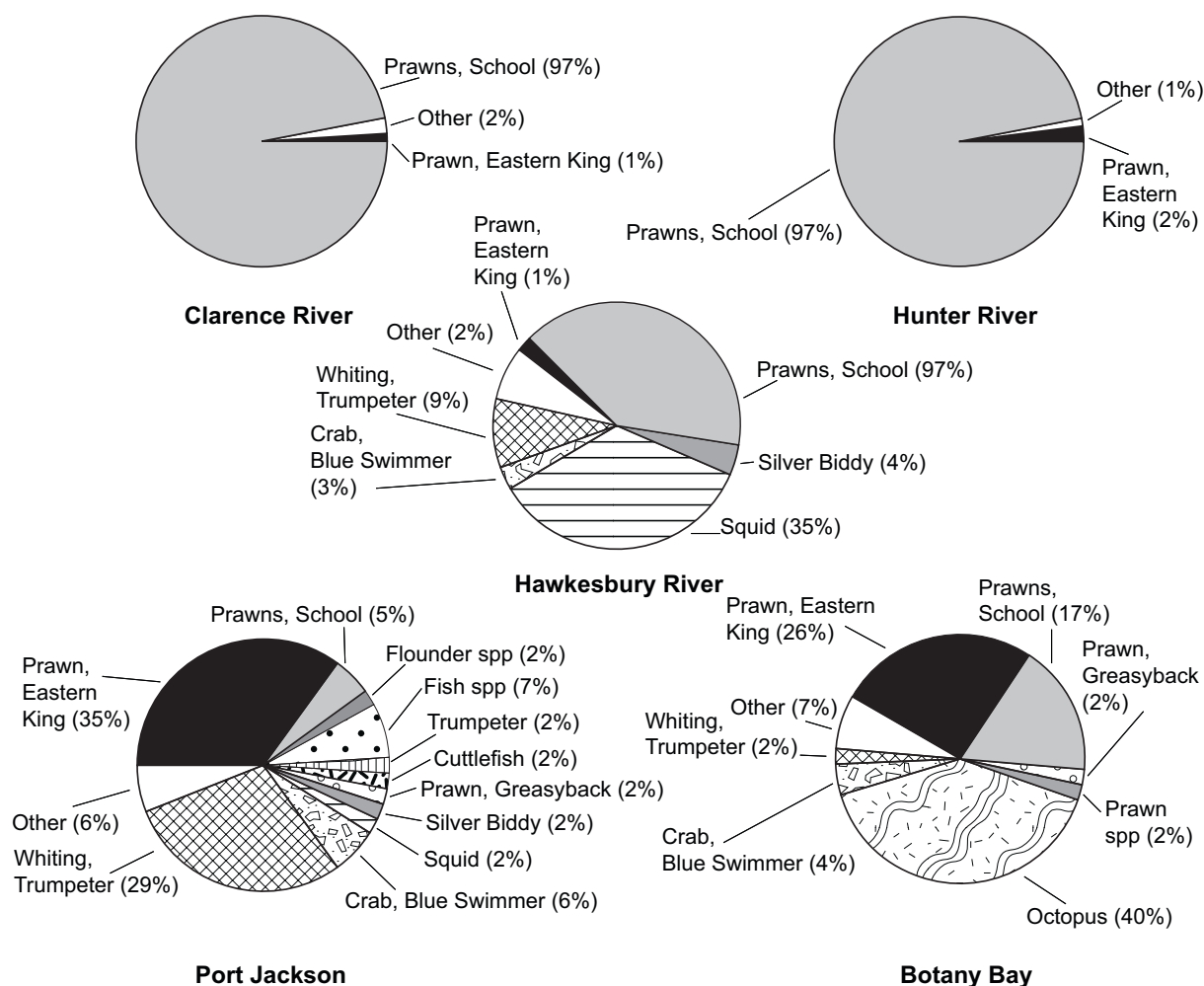
### Species of the Estuary Prawn Trawl Fishery



**Figure AB6.** The mean proportion of the most abundant species in the total annual reported landings for 1997-98 and 1998-99 of the Estuary Prawn Trawl Fishery.

The target species in the Estuary Prawn Trawl Fishery are prawns (for a list of species see Table AB13) and in the case of the Hawkesbury River, squid are also targeted as a target species. The fishery catches a wide range of species (see Appendix B1 on bycatch) but land relatively few of these (see Appendix B4 on landings of species). Overall, the school prawn *Metapenaeus macleayi* contributes by far the most to the catches of the Estuary Prawn Trawl Fishery followed by squid (Figure AB6), but these proportions change depending upon the estuary (Figure AB7). The contribution of target species to the total annual reported landings of the Clarence and Hunter Rivers is far greater than in those of the estuaries within the Sydney metropolitan area (Figure AB7).

In addition, the fishery takes a quantity of a small number of non target species that are caught as part of the prawn trawl and which have significantly contributed traditionally to the marketed catch of the fishery. These are referred to as byproduct species (Table B22). Bycatch refers to that part of the prawn trawl catch that is returned to the water and so is not landed.



**Figure AB7.** The mean proportion of the most abundant (by weight) species in the total annual reported landings for 1997-98 and 1998-99 from the Estuary Prawn Trawl Fishery in each estuary.

Descriptions of the target species and prominent byproduct species follow. Similar information about some of the other species may be found in the Fisheries Management Strategies for other fisheries or in the NSW Fisheries' 1998/99 *Status of Fisheries Resources* by Fletcher and McVea (2000), which can be found on the Department's website: [www.fisheries.nsw.gov.au](http://www.fisheries.nsw.gov.au)

The information in the following section has been extracted from a variety of sources including Grey *et. al.* (1983), Kailola *et. al.* (1993), Yearsley *et. al.* (1999), Pease and Grinberg (1995), Fletcher and McVea (2000), Montgomery (1990) and Montgomery *et. al.* (1995), Courtney *et. al.* (1995), Glaister (1977, 1978a, 1978b), Ruello (1971, 1973a, 1973b, 1975a, 1975b, 1975c and 1977) and the NSW Fisheries catch statistics database.

## Target species taken in the fishery

The target species (target species) in the Estuary Prawn Trawl Fishery are prawns (for a list of species see Table B21). The exception to this is the Hawkesbury River where squid are also recognised as a target species. Information about patterns in total annual reported landings and catch rates for each species within each estuary of the fishery can be found in Appendix B6.

**Table AB13.** The target species caught in each estuary by the Estuary Prawn Trawl Fishery.

"Yes" signifies that the species is a target species in that estuary. "No" signifies that the species is not a target species in that estuary.

| Common Name        | Scientific Name               | Estuary    |              |               |           |             |
|--------------------|-------------------------------|------------|--------------|---------------|-----------|-------------|
|                    |                               | Botany Bay | Port Jackson | Hawkesbury R. | Hunter R. | Clarence R. |
| Eastern King Prawn | <i>Penaeus plebejus</i>       | Yes        | Yes          | Yes           | Yes       | No          |
| School Prawn       | <i>Metapenaeus macleayi</i>   | Yes        | No           | Yes           | Yes       | Yes         |
| Broad Squid        | <i>Photololigo etheridgei</i> | No         | No           | Yes           | No        | No          |
| Bottle Squid       | <i>Lololus noctiluca</i>      | No         | No           | Yes           | No        | No          |

### School prawns (*Metapenaeus macleayi*)

School prawns are endemic to waters off the east coast of Australia and have been recorded from Tin Can Bay (Queensland) to Corner Inlet (Victoria) in depths from one m to 55 m.

There is no information on the larval stages of school prawns in the wild but it is thought that these conform to the general pattern found for penaeids and so have a larval stage of about two to three weeks. Nauplius larva hatch from the egg and develop through a series of moults into post-larvae. This is the transitional phase between the planktonic larva and benthic living juveniles.

Post-larval to adolescent school prawns inhabit estuaries and can be found in waters of very low salinity. Adult school prawns can occur in estuaries also, but are found predominantly in oceanic waters. School prawns have been found to occur on both bare and vegetated substrate within estuaries. Where both these substrate types occur in the one area, abundance has been found to be greatest on the vegetated substrate. Juvenile school prawns prefer a fine to medium sandy substratum. Adult school prawns are most abundant in turbid oceanic waters arising from estuarine discharge and here the size of the sediment particle appears to be less important in determining the distribution than the food content of the substratum.

Immature and mature prawns emigrate from estuarine waters to waters offshore predominantly between November and April each year and stay within approximately a 120 km radius of the estuary from which they emigrated.

School prawns live for 12-18 months. Little is known of the growth of school prawns, but they have been measured at sizes as large as around 33 mm Carapace Length (C.L.). School prawns in the Hunter River are mature at 25 and 23 mm C.L. for males and females, respectively. However, sizes of maturity may vary along the coast of New South Wales. School prawns spawn in waters of about 55 m depth off New South Wales between February and May.

School prawns are opportunistic omnivores. Food items include small crustaceans, annelid worms, bivalve molluscs and foraminifers. This species is eaten by most carnivorous marine species as well as higher order predators such as humans and birds.

There are several populations of school prawns along the east coast of Australia and NSW Fisheries manages the population in each estuary of the Estuary Prawn Trawl Fishery as a separate stock.

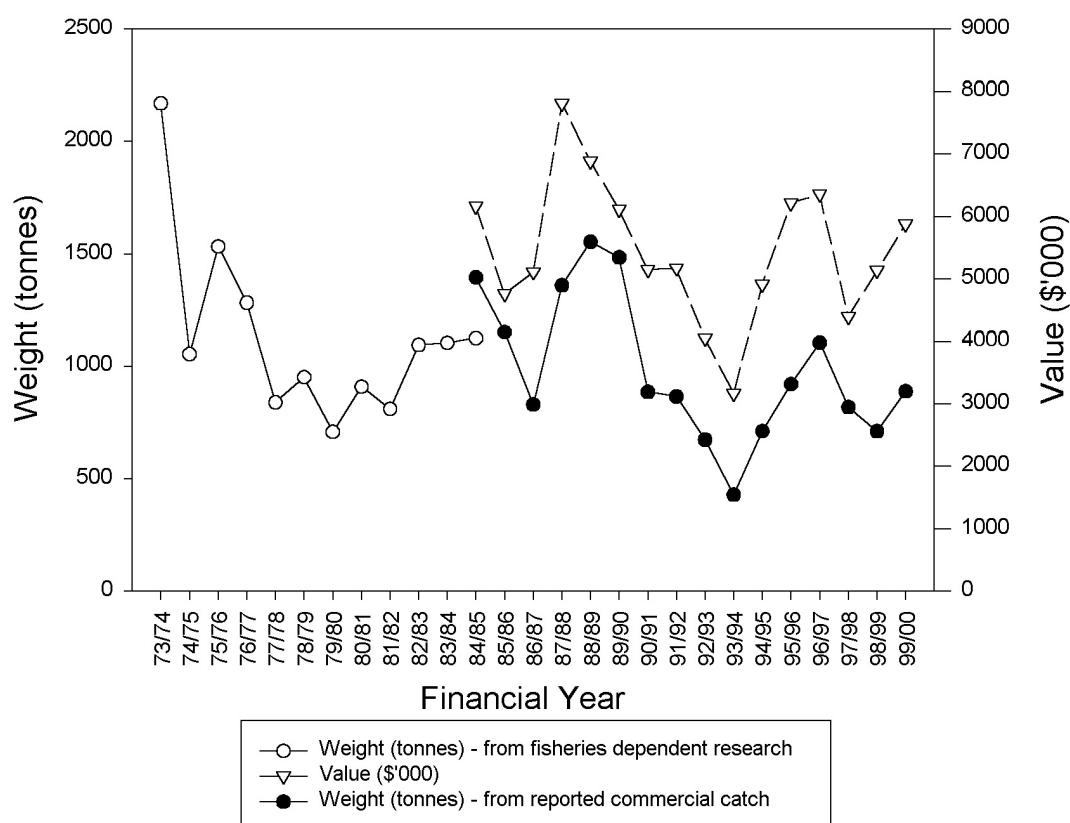
School prawns are harvested exclusively by otter trawling on grounds in ocean waters (Ocean Prawn Trawl Fishery) and in estuarine waters by the Estuary Prawn Trawl Fishery (otter trawling) and by numerous methods by the Estuary General Fishery (set pocket netting, running net, hauling, seining, six meter hand haul nets). The magnitude of the landed catch of school prawns from estuarine and offshore waters is correlated to river discharge.

There is a large domestic market for larger school prawns for human consumption, and substantial quantities, especially from the Clarence and Hawkesbury Rivers, are sold elsewhere as bait for recreational fishing.

School prawns are also exploited by recreational fishers within most estuaries across their distribution. Methods of fishing by recreational fishers include fishing with scoop nets, scissor nets and six metre hand hauled nets.

#### *Total annual reported landings for New South Wales*

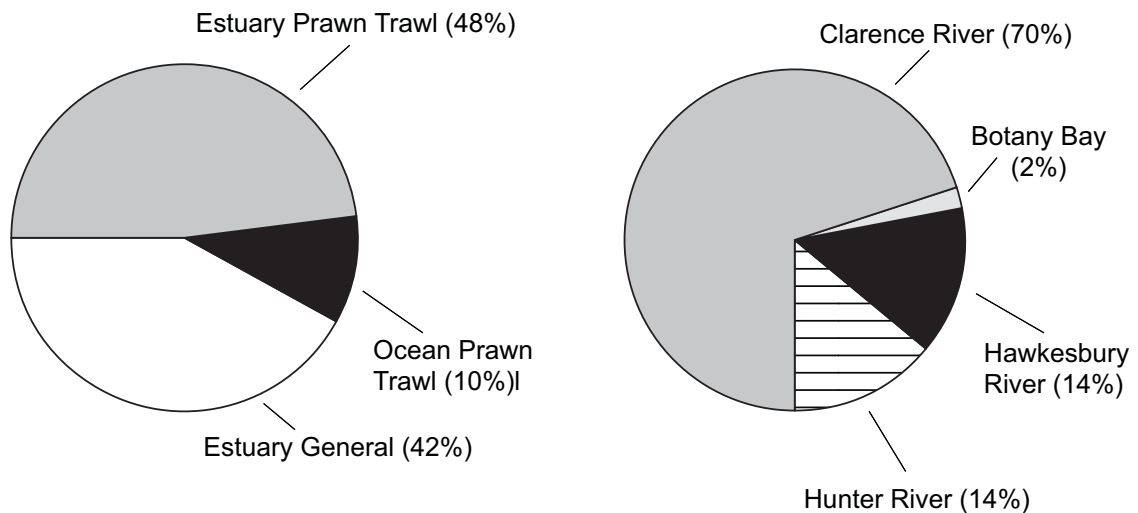
Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed the most to the total annual reported landings of school prawns for NSW, followed by the Estuary General and Ocean Prawn Trawl Fisheries (Figure AB9(a)). Data on total annual reported landings of school prawns for the whole of NSW are available from 1973-74. Total annual reported landings have fluctuated but from a high in 1973-74 have peaked at lower levels in 1989-90 and 1996-97 (Figure AB8). Fluctuations in total annual reported landings, particularly within each estuary are associated to fluctuations in river discharge. During times of high levels of river discharge prawns aggregate and are caught in greater numbers.



**Figure AB8.** Total annual reported landings (ocean and estuary) of school prawns for NSW.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).



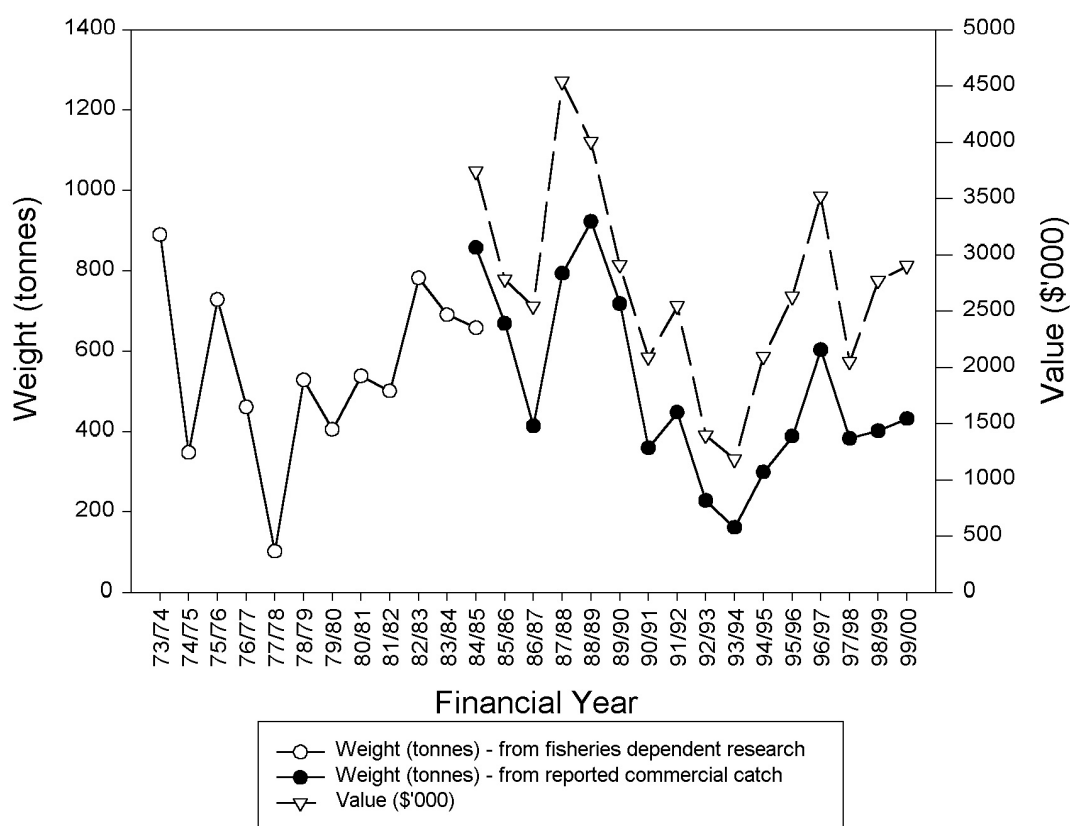


**Figure AB9.** The (a) mean proportion of total annual reported landings for 1997-98 and 1998-99 of school prawns contributed by each fishery in NSW and (b) mean proportion of total annual reported landings for 1997-98 and 1998-99 of school prawns from the Estuary Prawn Trawl Fishery contributed by each estuary.

*Total annual reported landings from each estuary of the Estuary Prawn Trawl Fishery*

Information on the pattern in landings of school prawns caught by the Estuary Prawn Trawl Fishery are available from 1984-85. Prior to this time catches from the different fisheries were grouped together. Prior to 1992-93 catches of school prawns for the Estuary Prawn Trawl Fishery may have been inflated as fishers could have attributed catches by other methods to Estuary Prawn Trawl Fishery. The relative contributions each estuary made to the total annual reported landings of school prawns in the Estuary Prawn Trawl Fishery are shown in Figure AB9(b). What follows is the pattern of landings from each estuary.

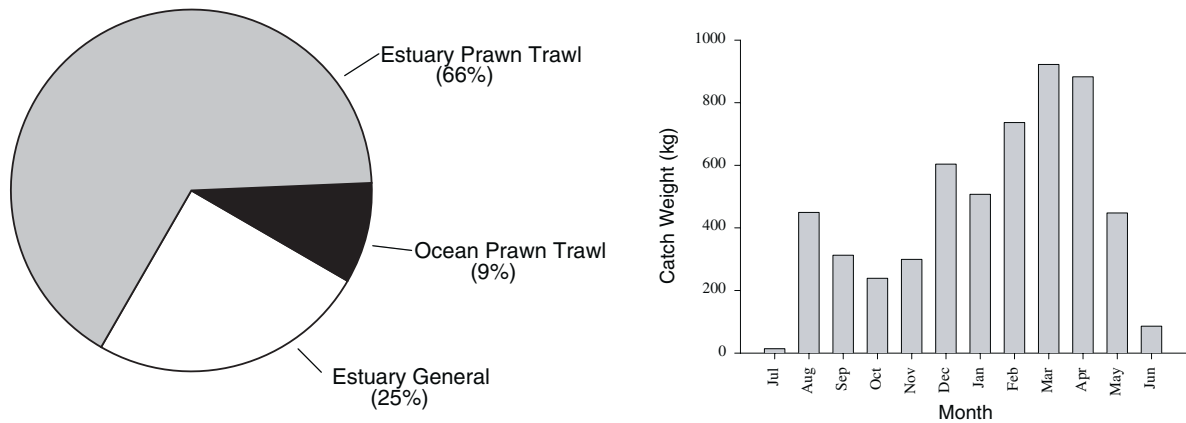
### Clarence River



**Figure AB10.** Total annual reported landings (ocean and estuary) of school prawns for the Clarence River NSW.

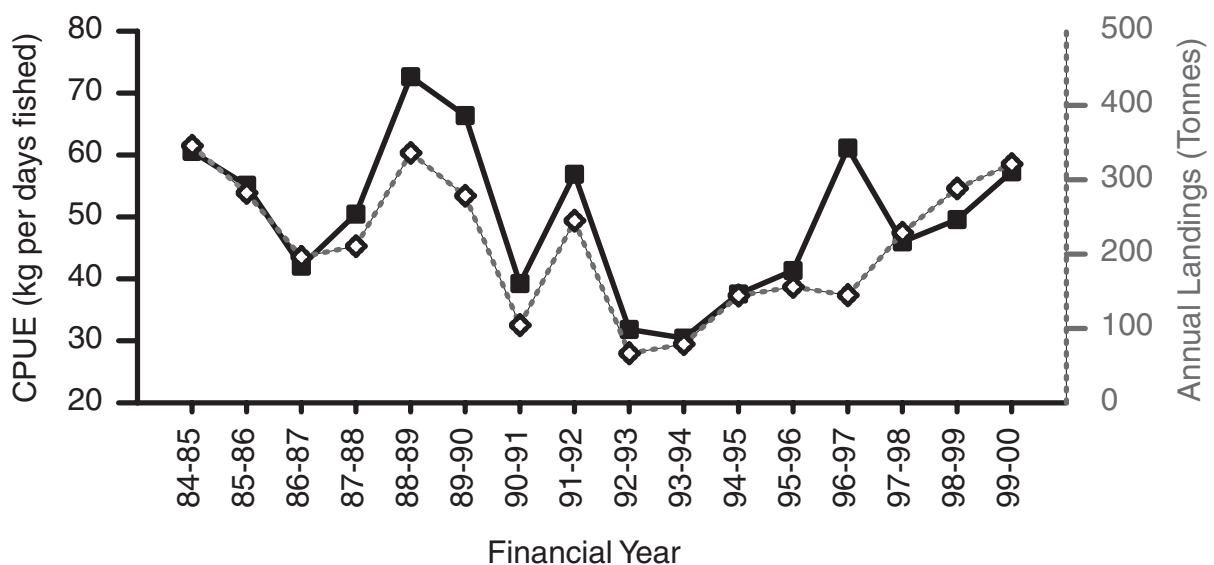
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

The Clarence River region is the major contributor of school prawns to the total annual reported landings for the species in New South Wales (Figure AB9(b)). Total annual reported landings by weight and value of school prawns amongst all fisheries in the Clarence River have fluctuated showing a downward trend since 1988-89 (Figure AB10).

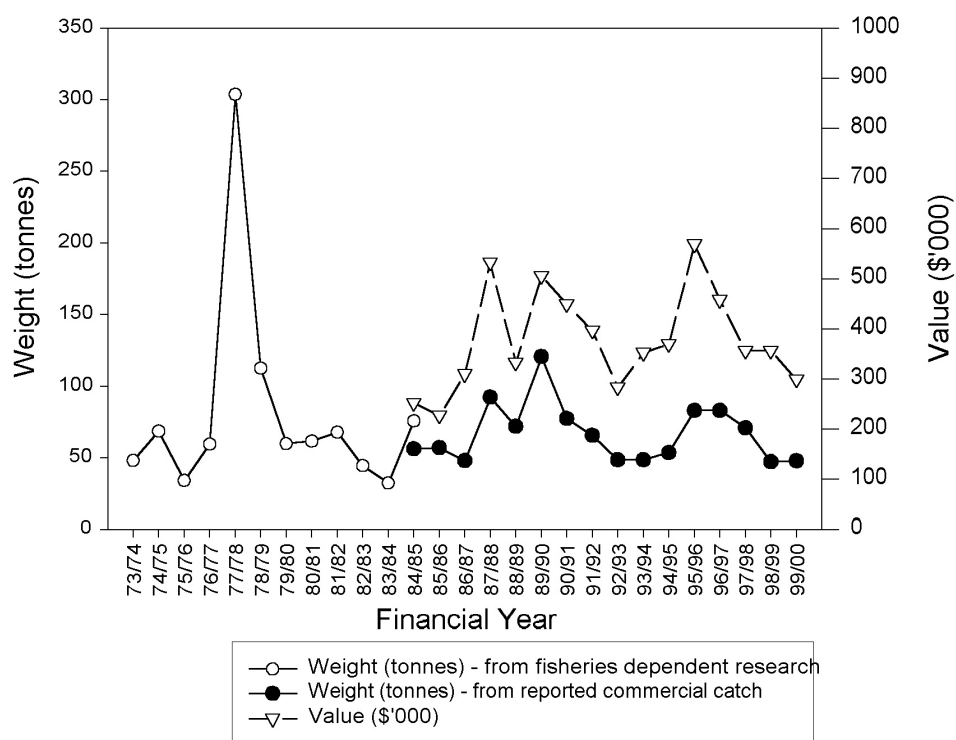


**Figure AB11.** The (a) mean proportion contributed by each fishery to the total annual reported landings of school prawns in the Clarence River and (b) mean monthly reported landings for 1997-98 and 1998-99 of school prawns in the Estuary Prawn Trawl Fishery on the Clarence River.

Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 66% by weight to the total annual reported landings of school prawns from the Clarence River (Figure AB11(a)). Mean annual reported landings of school prawns over the same period in the Estuary Prawn Trawl Fishery were highest between February and April (Figure AB11(b)). Total annual reported landings from the Estuary Prawn Trawl Fishery in the Clarence River show an overall downward trend between 1988-89 and 1993-94, but since then landings have risen in most years (Figure AB12). Catch rates peaked in 1988-89, then fell overall until 1992-93, and since then have risen (Figure AB12).



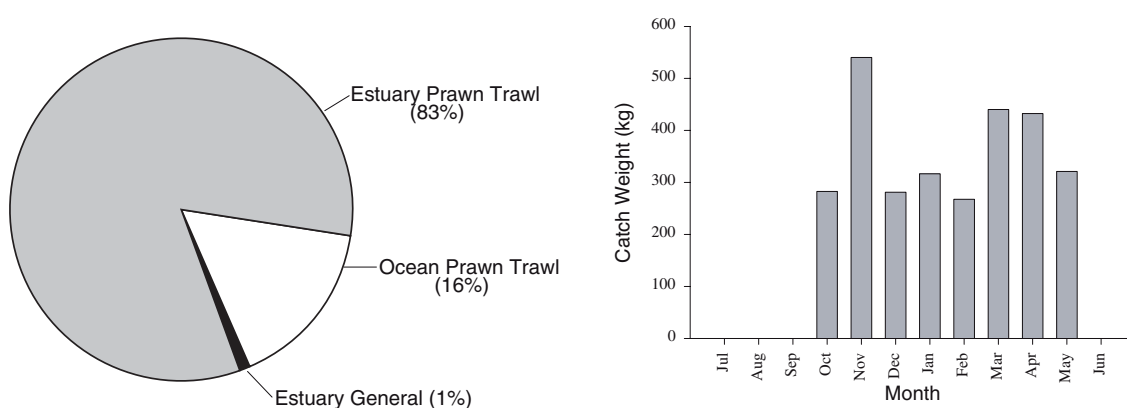
**Figure AB12.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of school prawns in the Estuary Prawn Trawl Fishery in the Clarence River.

**Hunter River**

**Figure AB13.** Total annual reported landings (ocean and estuary) of school prawns for the Hunter River.

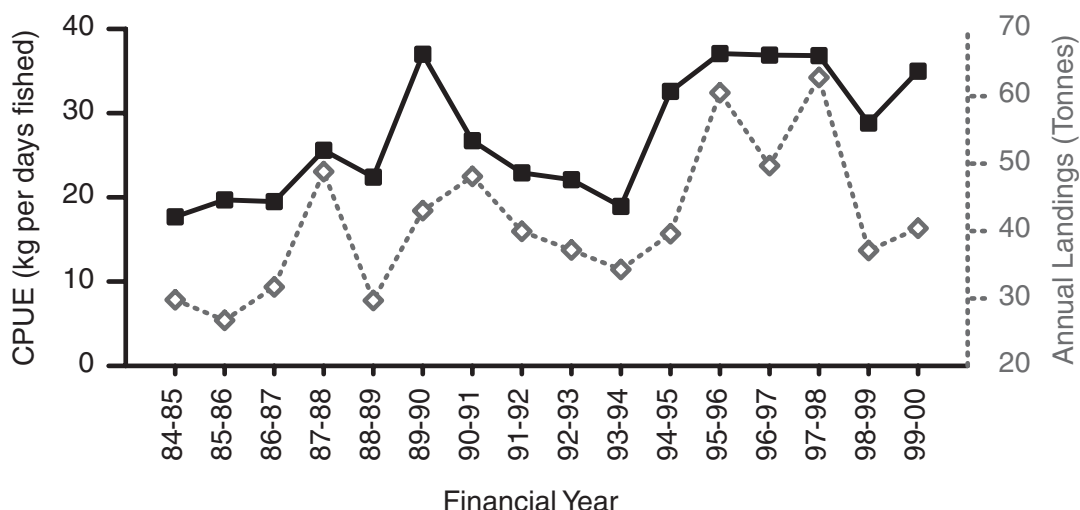
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value of school prawns amongst all fisheries in the Hunter River have remained relatively stable except for the peak landings in 1977-78 (Figure AB13).



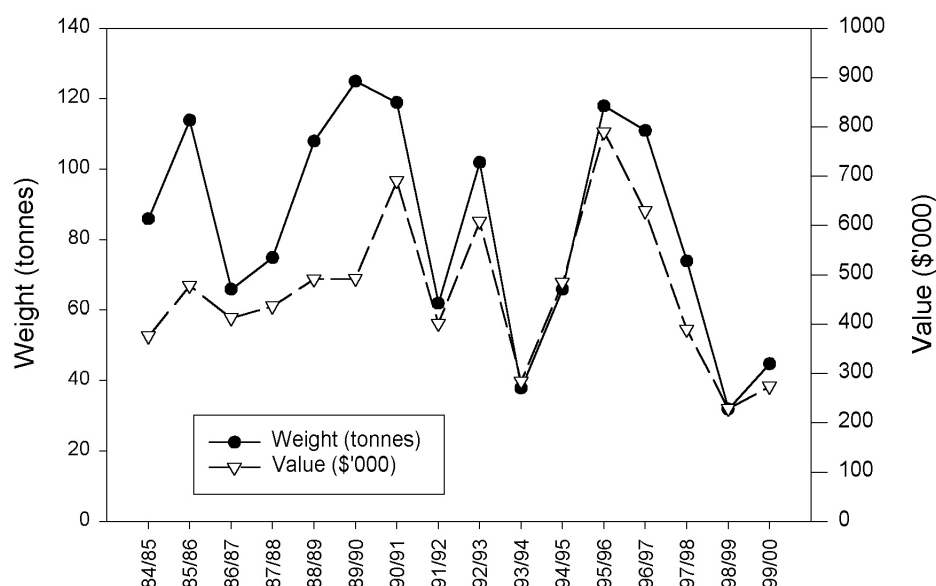
**Figure AB14.** The (a) mean proportion contributed by each fishery to the total annual reported landings of school prawns in the Hunter River and (b) mean monthly reported landings of school prawns for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery on the Hunter River.

Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 83% by weight to the total annual reported landings of school prawns from the Hunter River (Figure AB14(a)). Mean total annual reported landings of school prawns over the same period in the Estuary Prawn Trawl Fishery in the Hunter River were highest in November, March and April (Figure AB14(b)). Total annual reported landings for school prawns from the Estuary Prawn Trawl Fishery in the Hunter River have fluctuated but show an upward trend in most years since 1985-86 (Figure AB15). Catch rates remained relatively stable from 1984-85 to 1993-94, except for the peak in 1989-90 (Figure AB15). Since 1993-94 catch rates have risen to the level of the 1989-90 peak and generally have remained at about this level since 1995-96 (Figure AB15).



**Figure AB15.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of school prawns in the Estuary Prawn Trawl Fishery in the Hunter River.

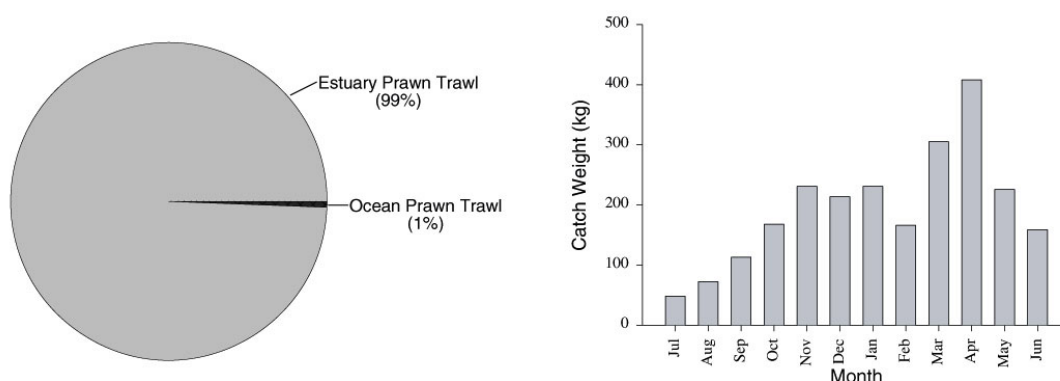
### *Hawkesbury River*



**Figure AB16.** Total annual reported landings (ocean and estuary) of school prawns for the Hawkesbury River.

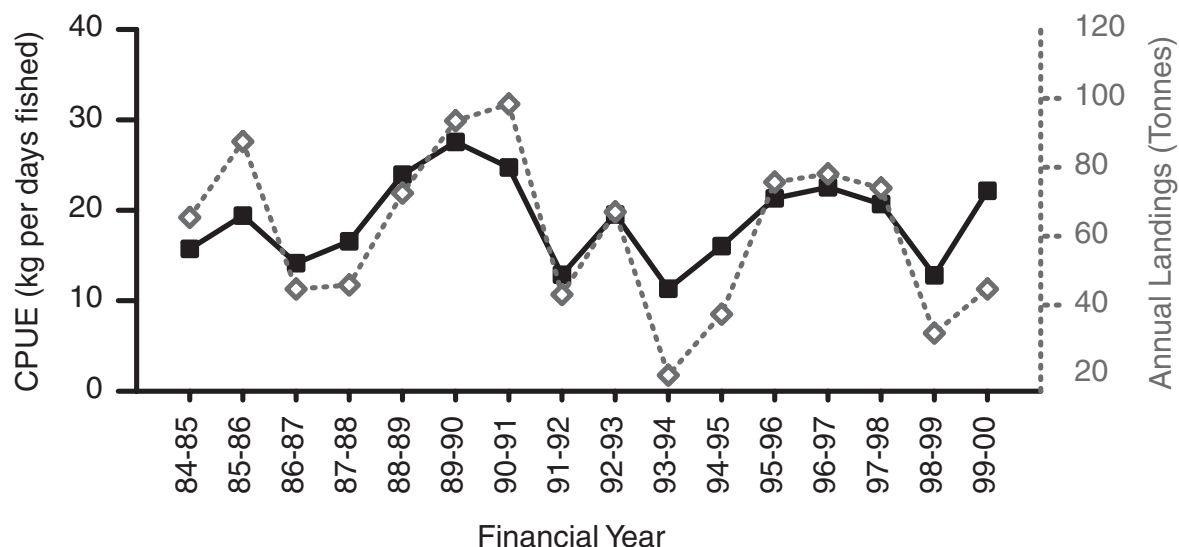
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value of school prawns amongst all fisheries in the Hawkesbury River have fluctuated greatly (Figure AB16).



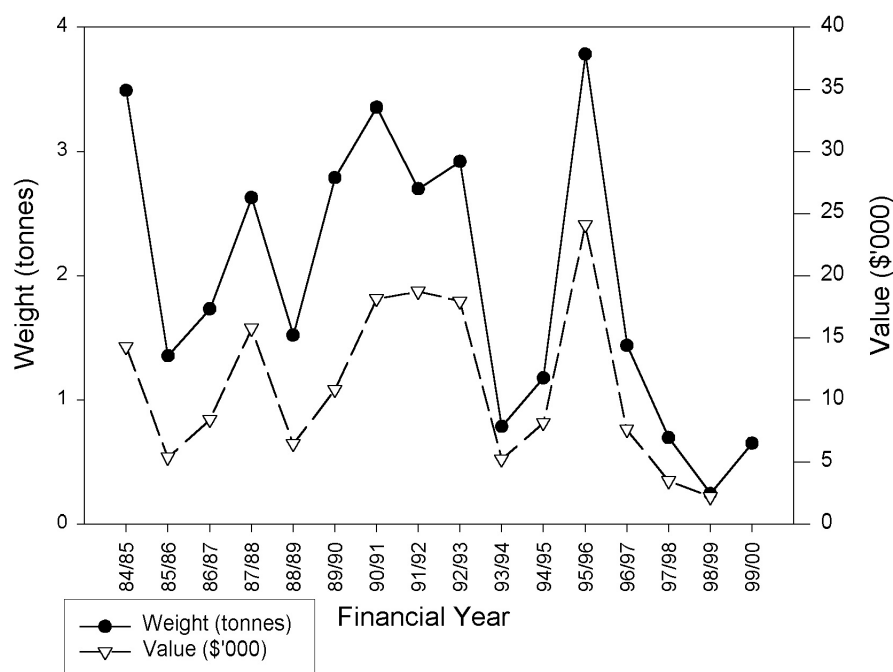
**Figure AB17.** The (a) mean proportion contributed by each fishery to the total annual reported landings of school prawns in the Hawkesbury River and (b) mean monthly reported landings of school prawns for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery on the Hawkesbury River.

Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 99% by weight to the total annual reported landings of school prawns from the Hawkesbury River (Figure AB17(a)). Mean total annual reported landings of school prawns over the same period in the Estuary Prawn Trawl Fishery in the Hawkesbury River were highest in March and April (Figure AB17(b)). Total annual reported landings for school prawns from the Estuary Prawn Trawl Fishery in the Hawkesbury River again have fluctuated greatly but show an overall downward trend (Figure AB18). Catch rates have fluctuated greatly, but overall have remained stable (Figure AB18).



**Figure AB18.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of school prawns in the Estuary Prawn Trawl Fishery in the Hawkesbury River.

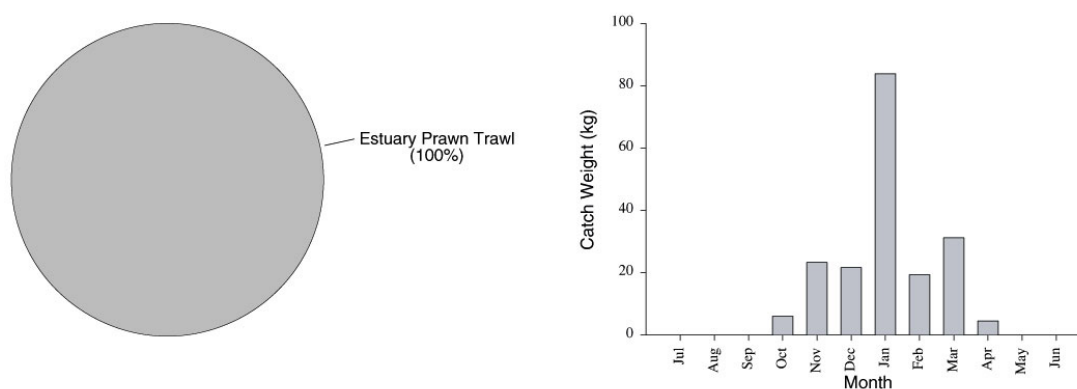
### Port Jackson



**Figure AB19.** Total annual reported landings (ocean and estuary) of school prawns for Port Jackson.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

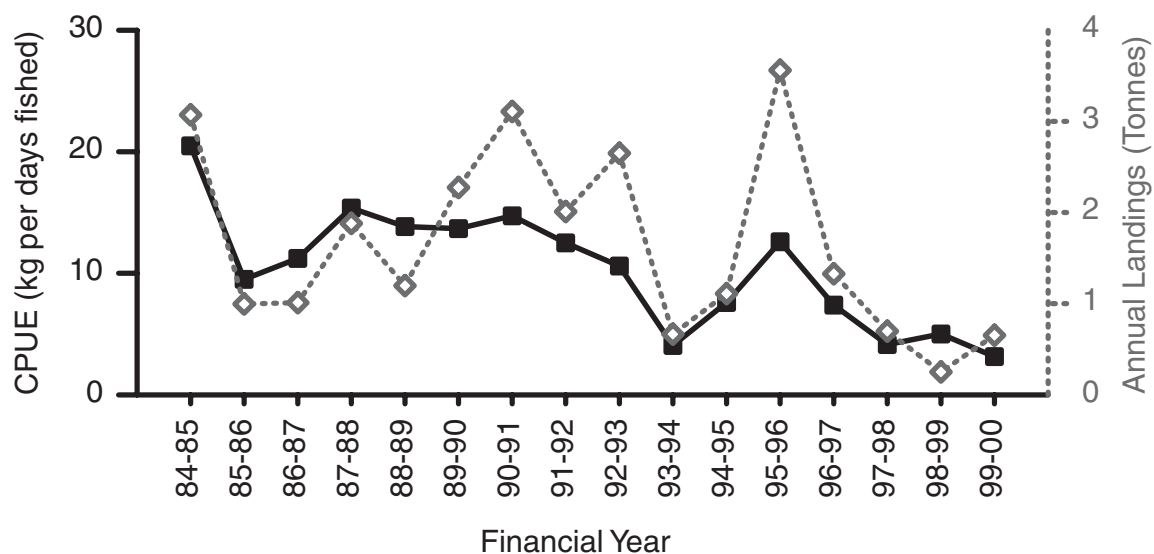
Total annual reported landings by weight and value of school prawns amongst all fisheries in Port Jackson have fluctuated greatly, but show an overall downward trend (Figure AB19).



**Figure AB20.** The (a) mean proportion contributed by each fishery to the total annual reported landings of school prawns in Port Jackson and (b) mean monthly reported landings of school prawns for 1987-98 and 1998-99 in the Estuary Prawn Trawl Fishery on Port Jackson.

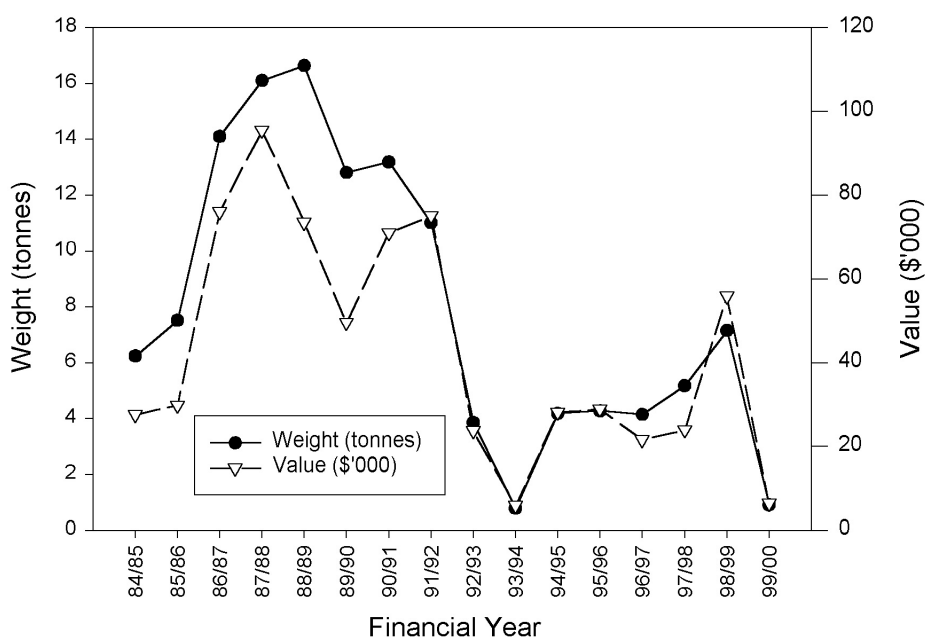
Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed all of the total annual reported landings of school prawns from Port Jackson (Figure AB20(a)). Mean total annual reported landings of school prawns over the same period in the Estuary Prawn Trawl Fishery in

Port Jackson were highest in January (Figure AB20(b)). Catch rates have fluctuated but show an overall downward trend (Figure AB21).



**Figure AB21.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of school prawns in the Estuary Prawn Trawl Fishery in Port Jackson.

### *Botany Bay*

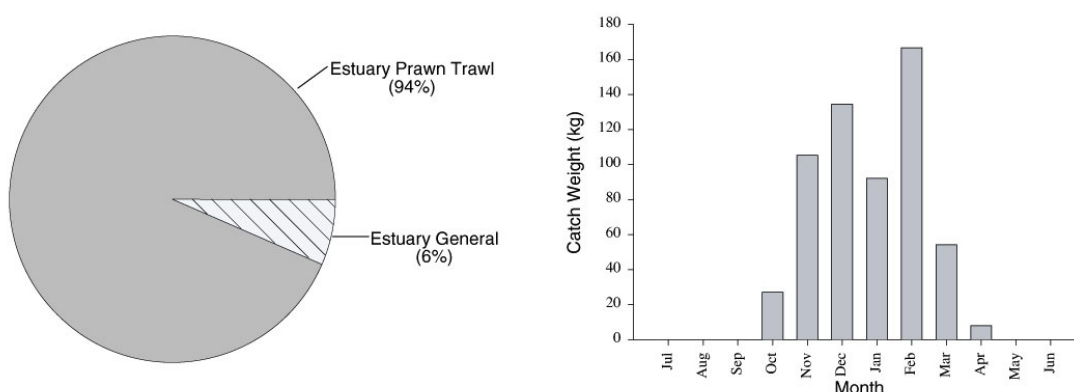


**Figure AB22.** Total annual reported landings (ocean and estuary) of school prawns for Botany Bay.

(**Note:** Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

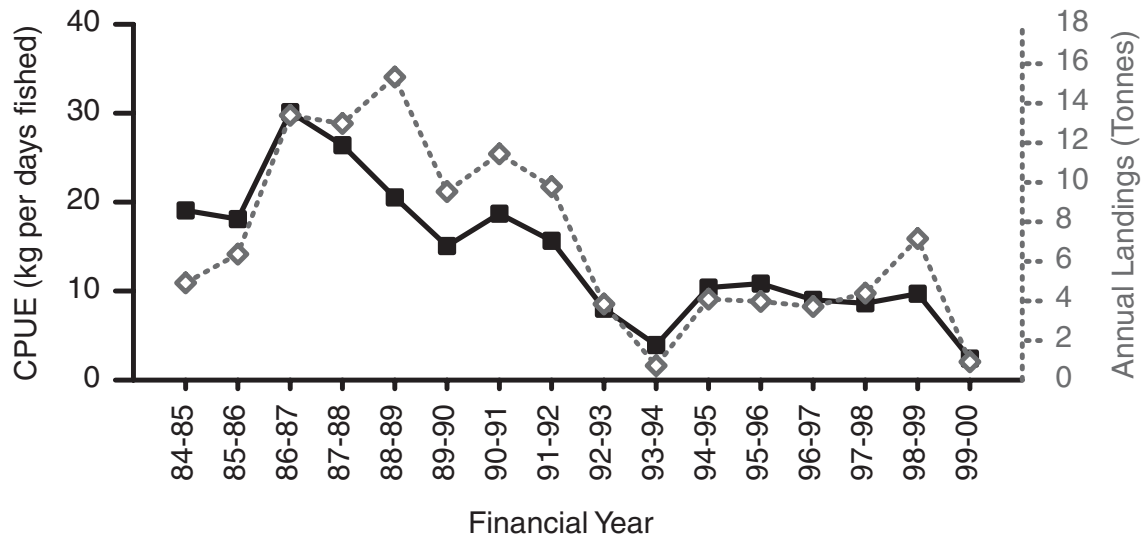
Total annual reported landings by weight and value for school prawns amongst all fisheries in Botany Bay rose from 1984-85 to peak in 1988-89 then fell until 1993-94 and have remained at slightly higher levels since then (Figure AB22).





**Figure AB23.** The (a) mean proportion contributed by each fishery to the total annual reported landings of school prawns in Botany Bay and (b) mean monthly reported landings of school prawns for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery on Botany Bay.

Over the period 1997-98 and 1998-99 the Estuary Prawn Trawl Fishery contributed a mean of 94% by weight to the landings from Botany Bay (Figure AB23(a)). Mean total annual reported landings of school prawns over the same period in the Estuary Prawn Trawl Fishery in Botany Bay were highest in February (Figure 23(b)). Total annual reported landings and catch rates in the Estuary Prawn Trawl Fishery in Botany Bay fell in most years between 1986-87 and 1993-94 (inclusive) and since then have remained stable at a slightly higher level than recorded for 1993-94 (Figure AB24).



**Figure AB24.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of school prawns in the Estuary Prawn Trawl Fishery in Botany Bay.

### Eastern king prawns (*Penaeus plebejus*)

Eastern king prawns are endemic to the waters off eastern Australia having been recorded from Mackay (Queensland) to north-east Tasmania in depths from 1 m to 200 m, and off Lord Howe Island.

Eastern king prawns live for around three years and in NSW waters reach maximum lengths of around 60 mm carapace length (C.L.) and 45 mm C.L., for females and males respectively. The shortest length at which 50% of female eastern king prawns carry eggs is 42 mm C.L. Eastern king

prawns spawn predominantly in waters from northern New South Wales to Swains Reef in Queensland. One female may carry up to 200,000 eggs. Larger female prawns carry more eggs than smaller ones.

There is no information on the length of time of the larval phase of the life cycle of eastern king prawns in the wild, but generally for prawn species it is around three weeks. Nauplius larvae hatch and develop through a series of moults into post-larvae. This is the transitional phase between the planktonic larva and benthic living juveniles.

Post-larval to adolescent eastern king prawns inhabit bare and vegetated substrate in areas of marine influence within estuaries and probably within shallow embayments in ocean waters. They emigrate from estuaries over spring and summer and then move northwards over long distances for what is thought to be for the purposes of spawning.

Eastern king prawns are opportunistic omnivores. Food items include small crustaceans, annelid worms, bivalve molluscs and foraminifers. Eastern king prawns are eaten by most carnivorous marine species and higher order predators such as humans and birds.

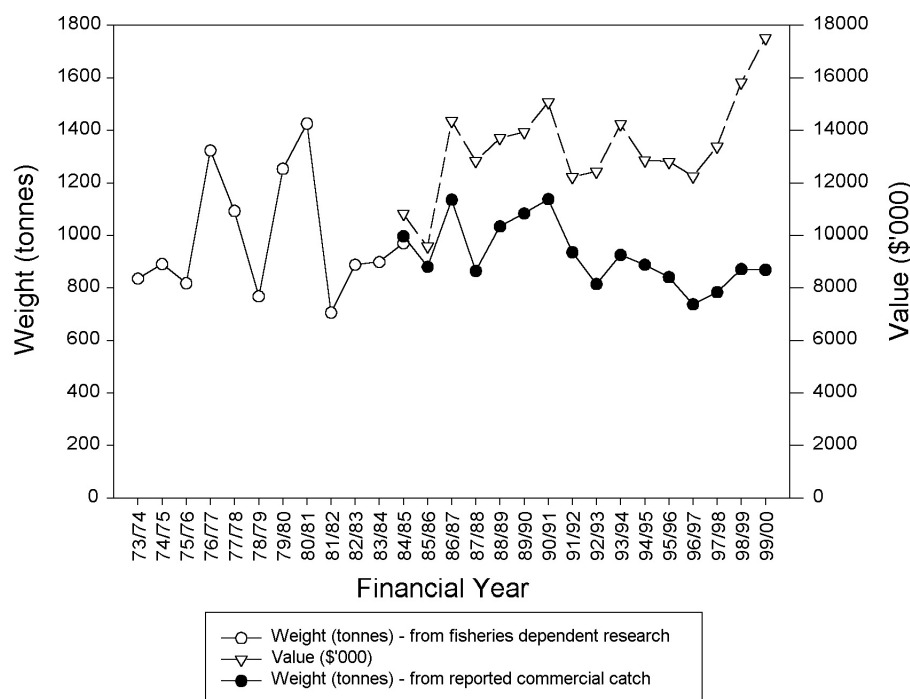
Eastern king prawns are one population along the east coast of Australia and are managed as a unit stock by NSW Fisheries. There is a large domestic market for eastern king prawns for human consumption.

This species is harvested exclusively on grounds in ocean waters by the Ocean Prawn Trawl Fishery (otter trawling) and in estuarine waters by the Estuary Prawn Trawl Fishery (otter trawling) and by numerous methods by the Estuary General Fishery (set pocket netting, running net, hauling, seining, six meter hand haul nets).

Eastern king prawns are also exploited by recreational fishers within most estuaries across its distribution. This species is the most abundant prawn species in the catches of recreational fishers in most estuaries, probably because recreational fishers fish for prawns at night when eastern king prawns are most active. Methods of fishing include fishing with scoop nets, scissor nets or six metre hand haul nets.

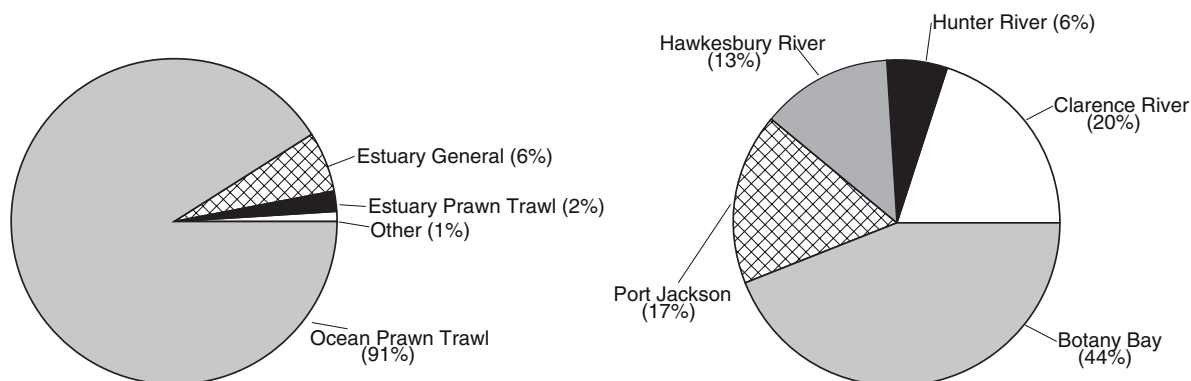
#### *Total annual reported landings for New South Wales*

Over the period 1997-98 and 1998-99, the Ocean Prawn Trawl Fishery contributed by far the most to the total annual reported landings of the species (Figure AB26(a)). Data on total annual reported landings of eastern king prawns are available from 1973-74. After peaks in 1976-77 and 1979-80 total annual reported landings rose from the low of 1981-82 to a high in 1990-91, then fell until 1995-96, and have risen since (Figure AB25).



**Figure AB25.** Total annual reported landings (ocean and estuary) of eastern king prawns for NSW.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

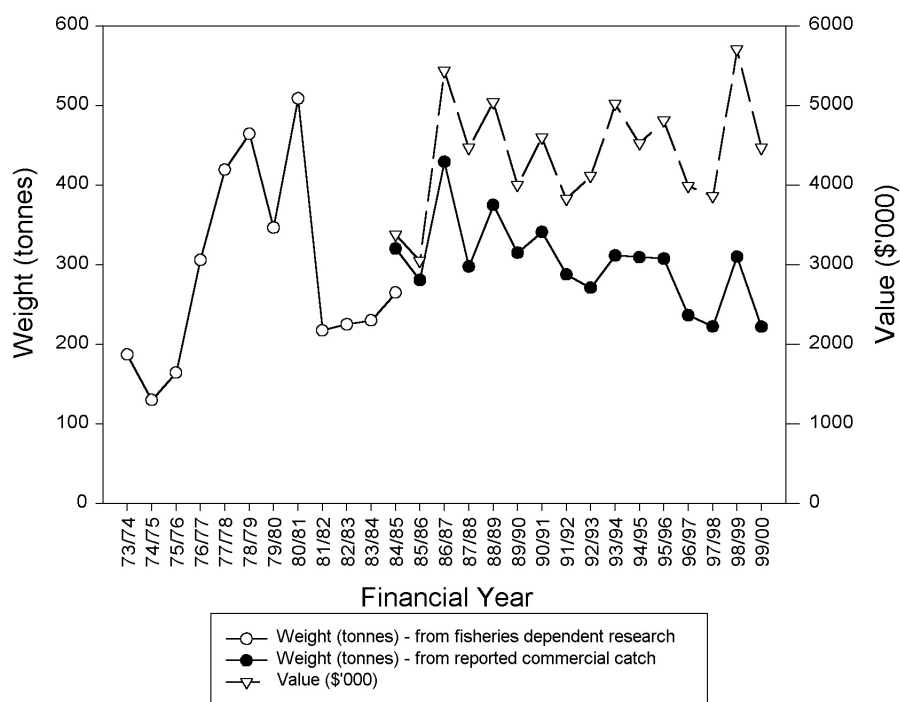


**Figure AB26.** The (a) mean proportion of total annual reported landings for 1997-98 and 1998-99 of eastern king prawns contributed by each fishery in NSW and (b) mean proportion of total annual reported landings for 1997-98 and 1998-99 of eastern king prawns from the Estuary Prawn Trawl Fishery contributed by each estuary.

#### *Total annual reported landings from each Estuary Prawn Trawl Fishery*

The relative contributions each estuary made to the total annual report landings of eastern king prawns in the Estuary Prawn Trawl Fishery are shown in Figure AB26(b). It is apparent that Botany Bay contributes the most to the landings.

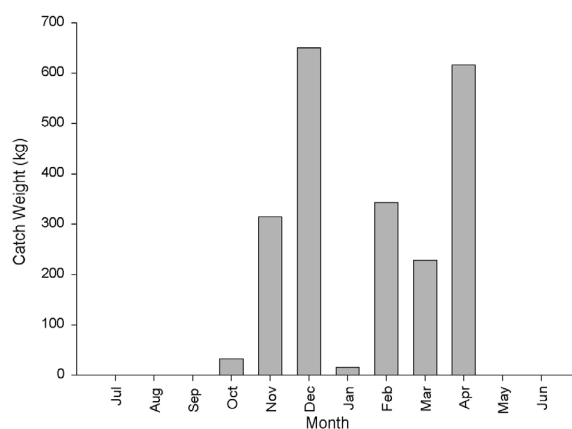
### Clarence River



**Figure AB27.** Total annual reported landings (ocean and estuary) of eastern king prawns for the Clarence River NSW.

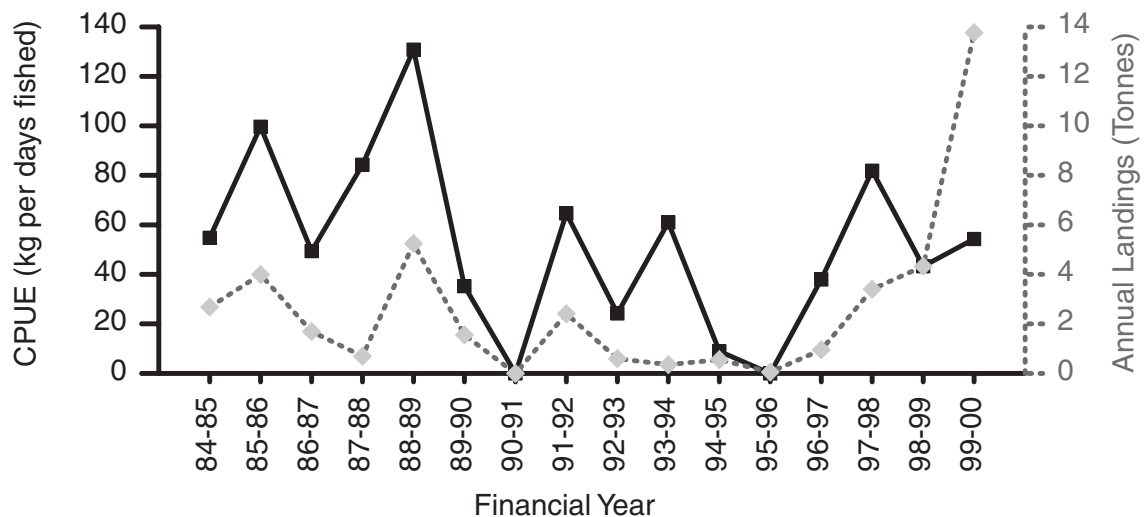
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

The Clarence River region is a major contributor to the total annual reported landings of eastern king prawns amongst all fisheries in NSW. Nearly all these catches (99%) are taken from ocean waters in the Ocean Prawn Trawl Fishery. Total annual reported landings by weight of eastern king prawns for all fisheries in the Clarence River rose from 1973-74 to peak in 1980-81, fell in 1981-82 and then rose again until 1986-87. Since 1986-87 total annual reported landings have fluctuated but in a downward pattern. (Figure AB27).



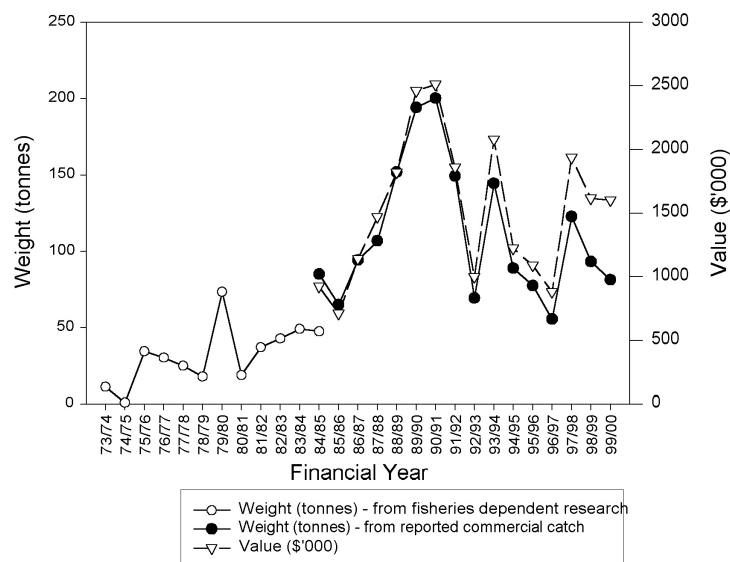
**Figure AB28.** Mean monthly reported landings for 1997-98 and 1998-99 of eastern king prawns in the Estuary Prawn Trawl Fishery on the Clarence River.

Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 1% by weight to the total annual reported landings of eastern king prawns in the Clarence River. Mean total annual reported landings of eastern king prawns over the same period in the Estuary Prawn Trawl Fishery in the Clarence River were highest in December and April (Figure AB28). Total annual reported landings from the Estuary Prawn Trawl Fishery in the Clarence River fluctuated during the 1980's but showed a downward trend that continued until 1995-96 (Figure AB29). Since then landings have risen. Catch rates in the Estuary Prawn Trawl Fishery for eastern king prawns in the Clarence River fluctuated greatly (Figure AB29).



**Figure AB29.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of eastern king prawns in the Estuary Prawn Trawl Fishery in the Clarence River.

### *Hunter River*

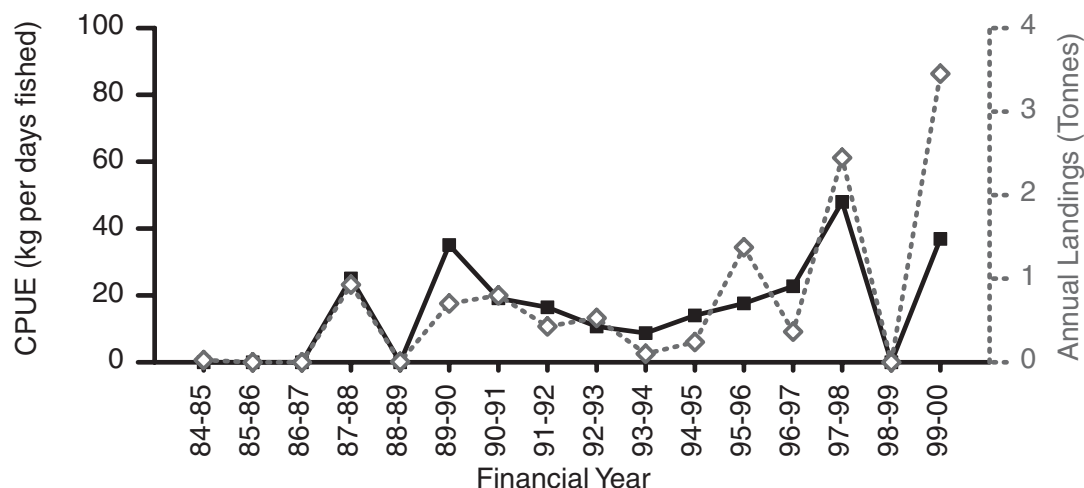


**Figure AB30.** Total annual reported landings (ocean and estuary) of eastern king prawns for the Hunter River.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

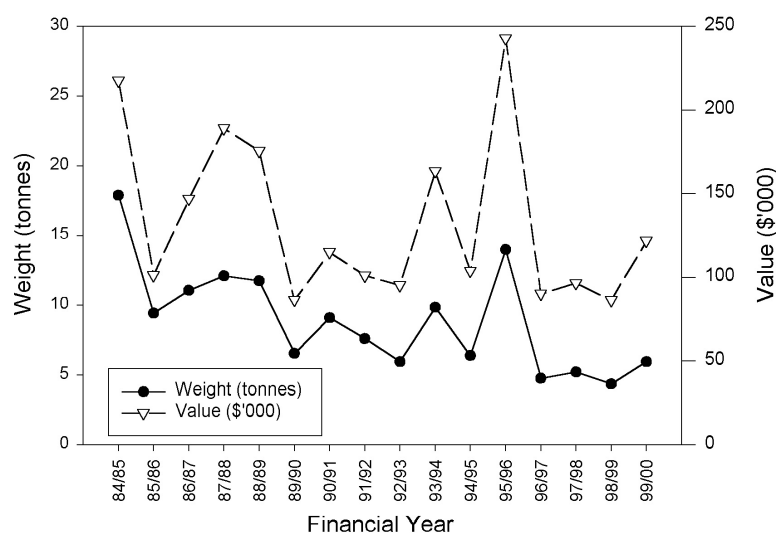
Total annual reported landings of eastern king prawns amongst all fisheries in the Hunter River rose in most years from 1980-81 until 1990-91, then fell in most years until 1996-97 and have fluctuated about this level since then (Figure AB30). Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 1% by weight to the total annual reported landings of eastern king prawns in the Hunter River.

Because of the low quantities caught, the seasonal pattern in landings is not shown. Catch rates in the Estuary Prawn Trawl Fishery in the Hunter River were zero in all but one year between 1984-85 to 1988-89 (inclusive) (Figure AB31). Catch rates fell from 1989-90 until 1993-94, then rose until 1997-98 (Figure AB31).



**Figure AB31.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of eastern king prawns in the Estuary Prawn Trawl Fishery in the Hunter River.

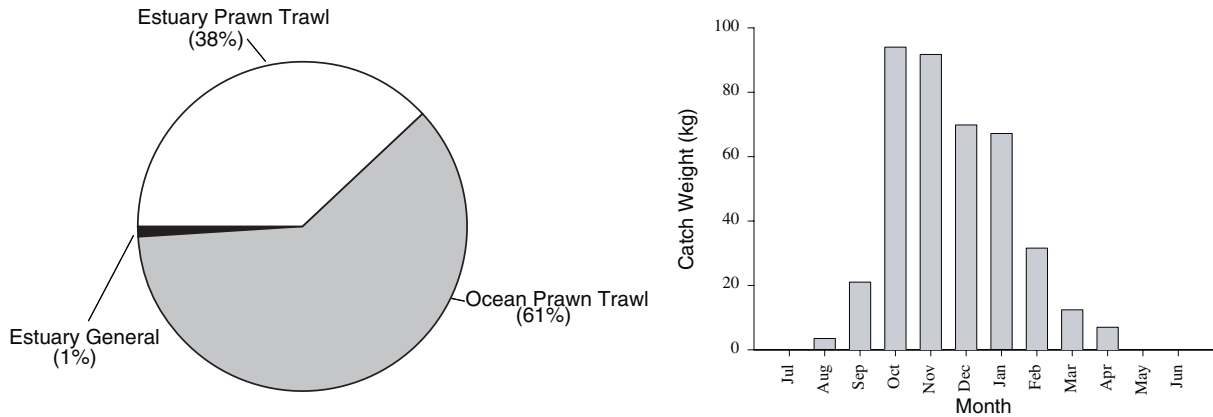
### *Hawkesbury River*



**Figure AB32.** Total annual reported landings (ocean and estuary) of eastern king prawns for the Hawkesbury River.

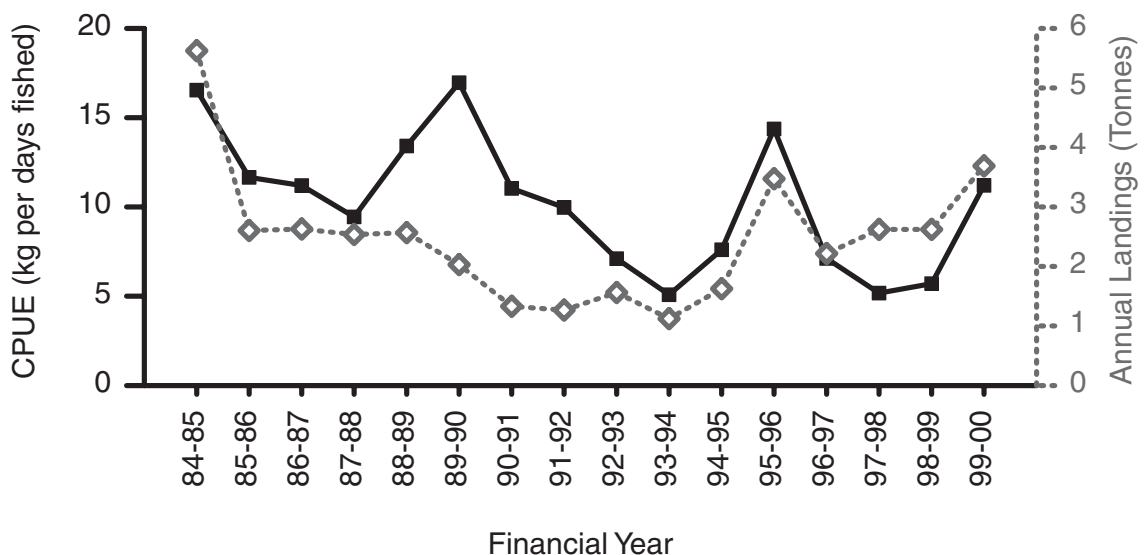
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight of eastern king prawns amongst all fisheries in the Hawkesbury River have fluctuated and show a downward pattern since 1984-85 (Figure AB32). During 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed around a mean of 38% by weight to the total annual reported landings of eastern king prawns in the Hawkesbury River (Figure AB33(a)).



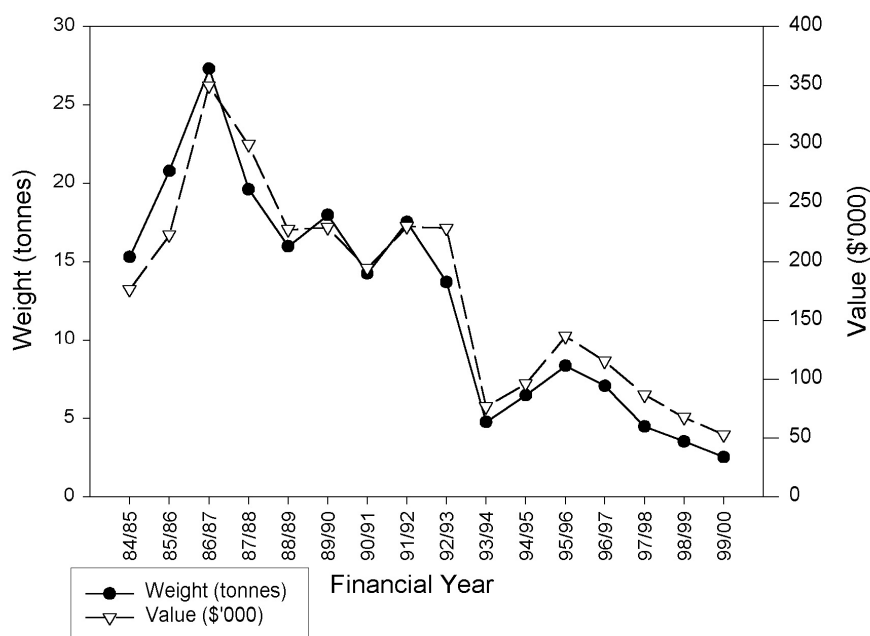
**Figure AB33.** The (a) mean proportion contributed by each fishery to the total annual reported landings of eastern king prawns in the Hawkesbury River and (b) mean monthly reported landings of eastern king prawns for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery on the Hawkesbury River.

Mean total annual reported landings of eastern king prawns over the same period in the Estuary Prawn Trawl Fishery in the Hawkesbury River were highest between in October and November (Figure AB33(b)). Levels of total annual reported landings for the Estuary Prawn Trawl Fishery in the Hawkesbury River fell in most years between 1984-85 and 1993-94 but have tended to rise in years since then (Figure AB34). Catch rates of the Estuary Prawn Trawl Fishery in the Hawkesbury River again fell in most years between 1984-85 and 1993-94 and have fluctuated since then (Figure AB34).



**Figure AB34.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of eastern king prawns in the Estuary Prawn Trawl Fishery in the Hawkesbury River.

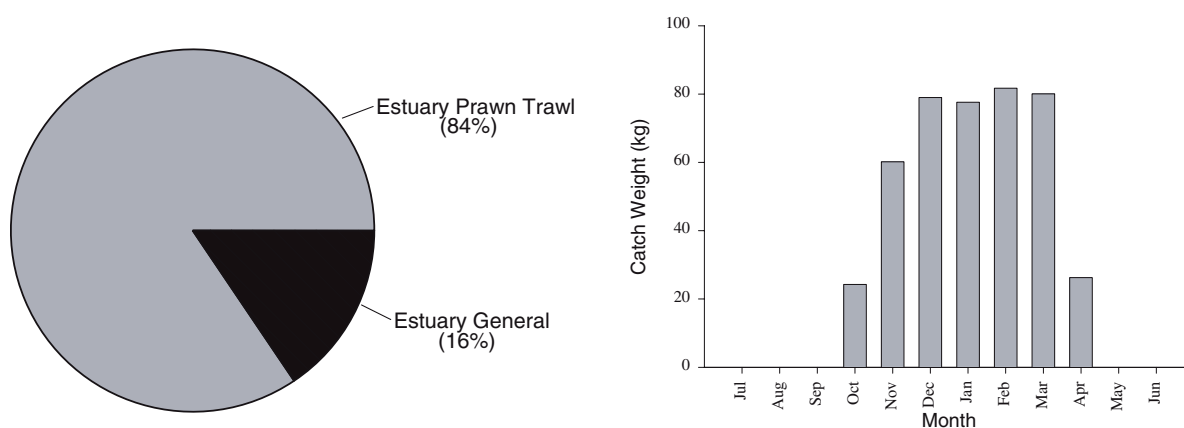
### Port Jackson



**Figure AB35.** Total annual reported landings (ocean and estuary) of eastern king prawns for Port Jackson.

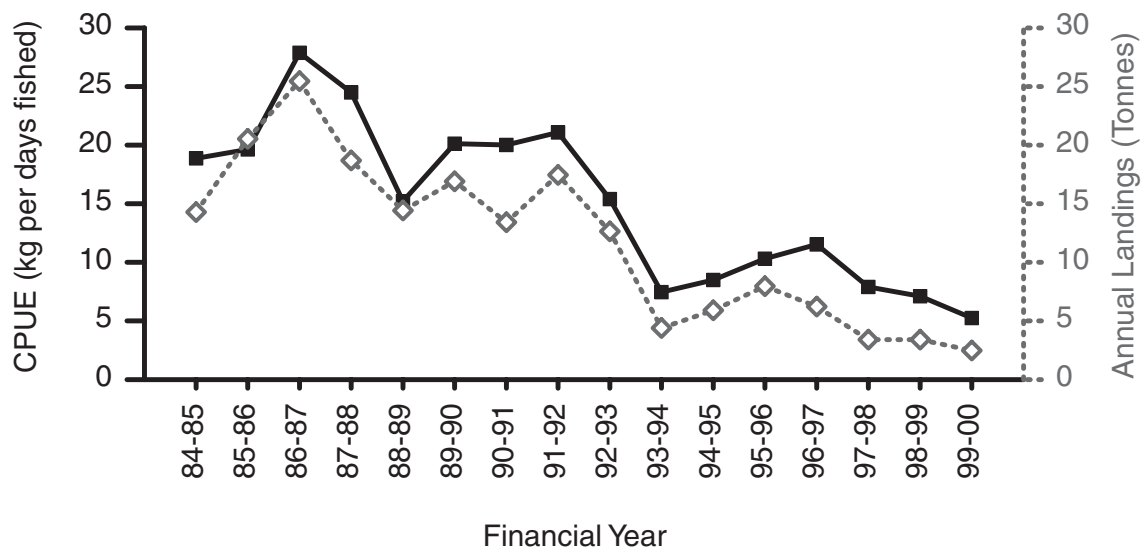
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 84% by weight to the total annual reported landings of eastern king prawns from Port Jackson (Figure AB36(a)). Mean annual reported landings of eastern king prawns over the same period within the regulated fishing season occurred between December and March (Figure AB36(b)). Total annual reported landings by weight and value of eastern king prawns for both all fisheries combined and for the Estuary Prawn Trawl Fishery in Port Jackson peaked in 1986-87 and have fallen in most years since then (Figure AB35 & AB37). The pattern in catch rates for the Estuary Prawn Trawl Fishery is very similar to the pattern for total annual reported landings (Figure AB37).



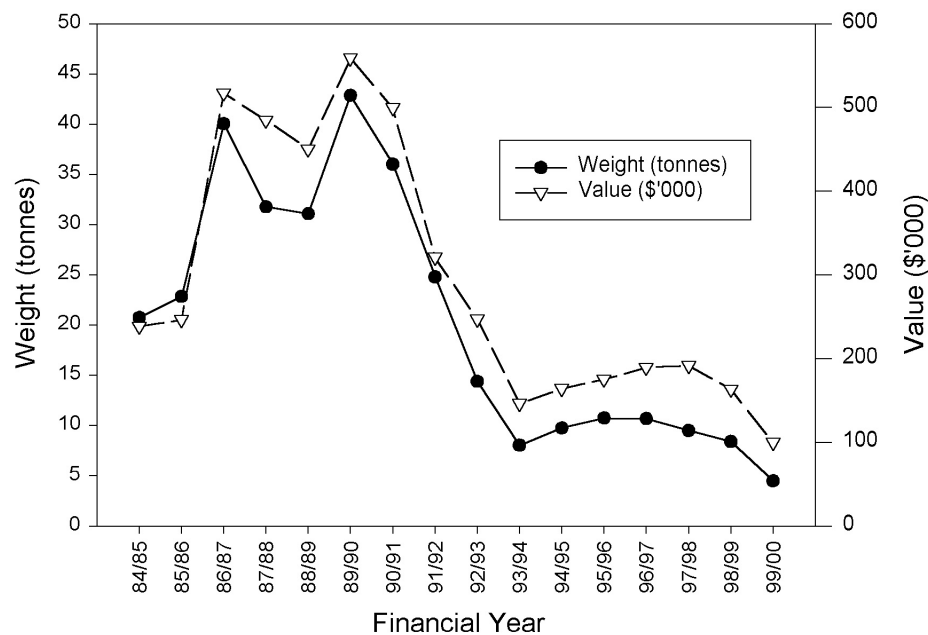
**Figure AB36.** The (a) mean proportion contributed by each fishery to the total annual reported landings of eastern king prawns in Port Jackson and (b) mean monthly reported landings of eastern king prawns for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery in Port Jackson.





**Figure AB37.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of eastern king prawns in the Estuary Prawn Trawl Fishery in Port Jackson.

### *Botany Bay*

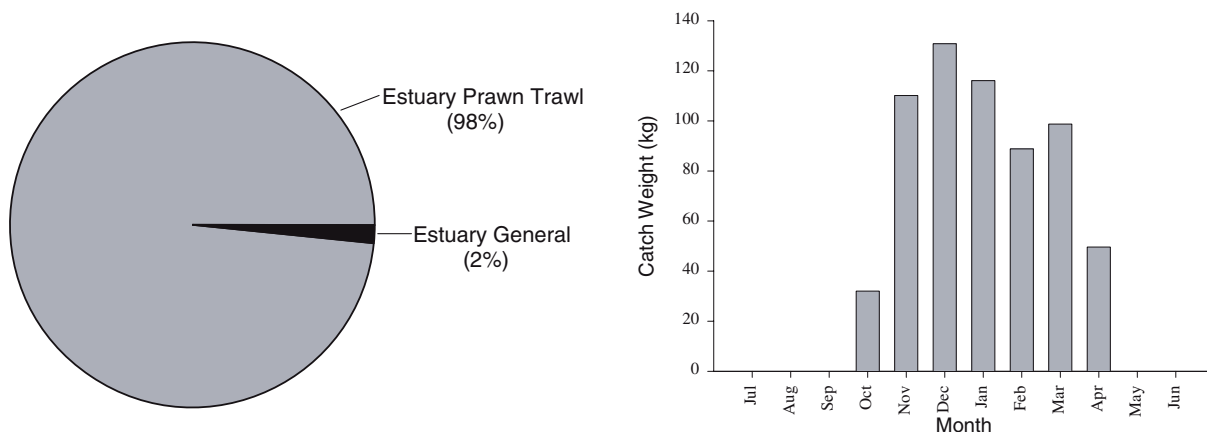


**Figure AB38.** Total annual reported landings (ocean and estuary) of eastern king prawns for Botany Bay.

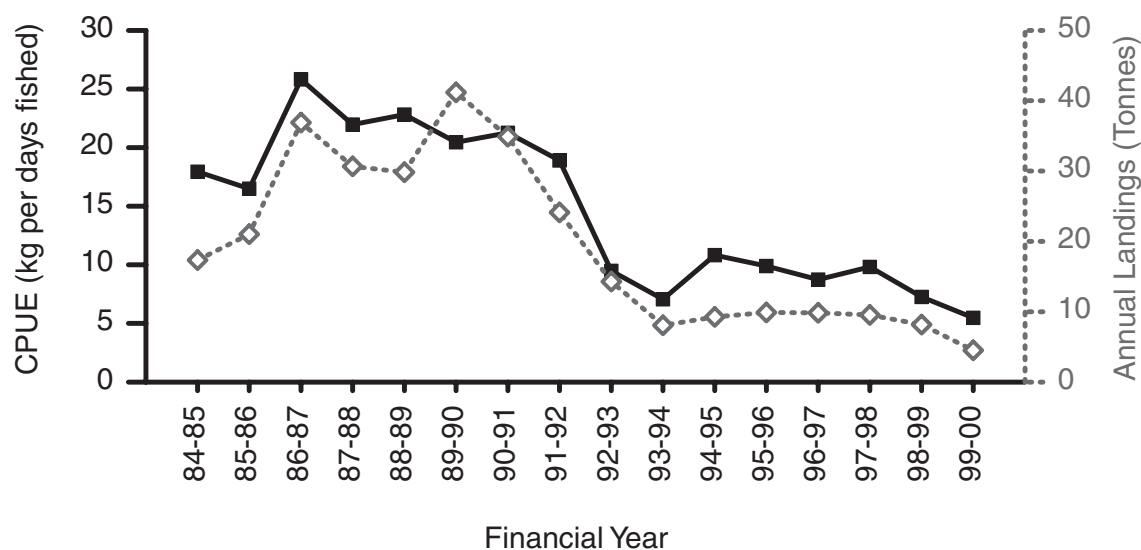
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value of eastern king prawns amongst all fisheries in Botany Bay (Figure AB38) is the same as those for the Estuary Prawn Trawl Fishery operating in Botany Bay because this fishery contributes the most to these landings. Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 98% by weight to the total annual reported landings from Botany Bay (Figure AB39(a)). Mean annual reported landings of

eastern king prawns over the same period in the Estuary Prawn Trawl Fishery in Botany Bay were greatest between November and January (Figure AB39(b)). Total annual reported landings for all fisheries combined and for the Estuary Prawn Trawl Fishery peaked in 1986-87 and 1989-90, then fell until 1993-94 and since then have remained stable at the 1993-94 level (Figure AB40). Catch rates for the Estuary Prawn Trawl Fishery have fallen in most years since 1986-87 (Figure AB40).



**Figure AB39.** The (a) mean proportion contributed by each fishery to the total annual reported landings of eastern king prawns in Botany Bay and (b) mean monthly reported landings of eastern king prawns for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery in Botany Bay.



**Figure AB40.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of eastern king prawns in the Estuary Prawn Trawl Fishery in Botany Bay.

#### B6.1.4 Squid families (members of the Loliginade family)

There are several species of squid caught in the Estuary Prawn Trawl Fishery, the main species being broad squid (*Photololigo etheridgei*) and bottle squid (*Lololus noctiluca*). Squid are a targeted species in the Hawkesbury River only and are caught as a byproduct species in the other estuaries of the Estuary Prawn Trawl Fishery.

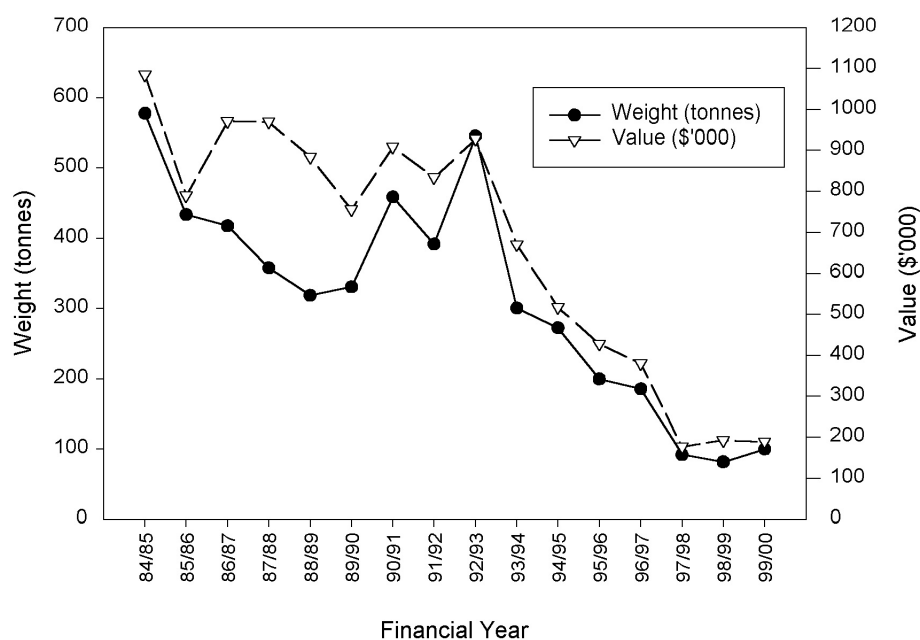
Broad squid are distributed from Shark Bay (WA) to Botany Bay (NSW). They inhabit shallow water on the continental shelf as well as coastal bays and inlets, but they have been caught in waters as

deep as 300 m. They occur elsewhere in the Indo-Pacific region and live throughout the western Pacific to Japan, including the south and east China Seas.

Little is known of the life history of broad squid. In the western Pacific Ocean they spawn throughout the year, although activity peaks in February to May and August to November. There is no information on the growth of broad squid, but preliminary results from research done by the University of Sydney on the population of broad squid in the Hawkesbury River suggest that this species reaches a maximum mantle length of around 30 cm.

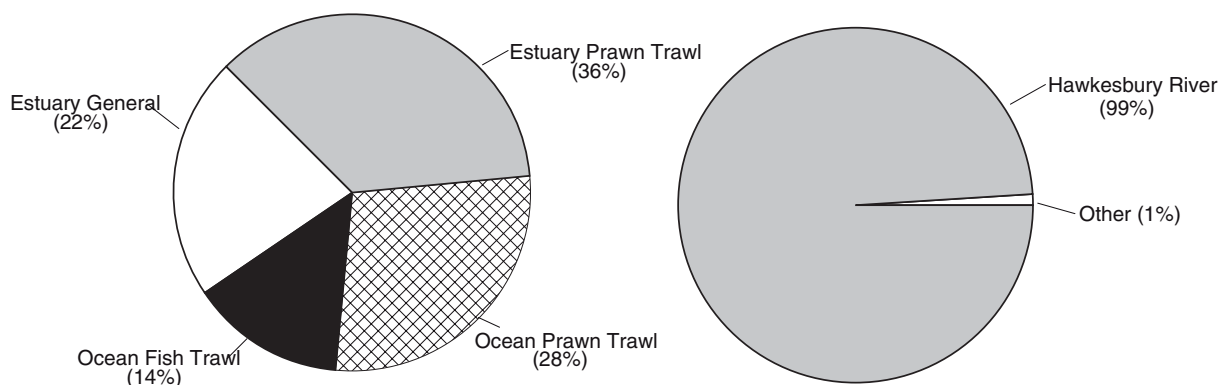
#### *Total annual reported landings for New South Wales*

Information on the catches of squid for the whole of New South Wales across ocean and estuarine waters includes several species; namely *Lololus noctiluca*, *Photololigo etheridgei*, *Photololigo* sp., *Nototodarus gouldi*. The total annual reported landings for squid across all fisheries in NSW have fallen in most years since data were first available (Figure AB41). The exception to this is 1989-90 to 1990-93 when total annual landings rose (Figure AB41). In contrast, those for squid from the Hawkesbury River have risen (Figure AB43). Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl and Ocean Line and Trap Fisheries contributed most to the total annual reported landings of the species (Figure AB42(a)). The fishery in the Hawkesbury River contributed nearly all the landings of the Estuary Prawn Trawl Fishery (Figure AB42(b)).



**Figure AB41.** Total annual reported landings (ocean and estuary) of squid for NSW.

(**Note:** Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

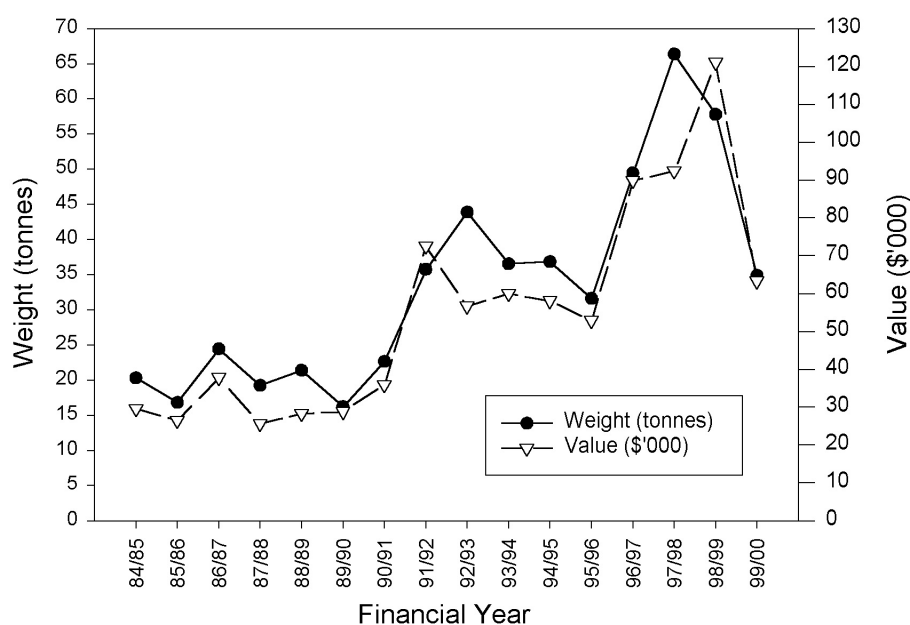


**Figure AB42.** The (a) mean proportion of total annual reported landings for 1997-98 and 1998-99 of squid contributed by each fishery in NSW and (b) mean proportion of total annual reported landings for 1997-98 and 1998-99 of squid from the Estuary Prawn Trawl Fishery contributed by each estuary.

#### *Total annual reported landings from each Estuary Prawn Trawl Fishery*

The relative contributions each estuary made to the total annual reported landings of squid are shown in Figure AB42(a). It is apparent that the fishery in the Hawkesbury River contributes most to the total annual reported landings of squid by the Estuary Prawn Trawl Fishery, and for this reason patterns in total annual reported landings by the Estuary Prawn Trawl Fishery in the Hawkesbury River are the only patterns discussed.

#### ***Hawkesbury River***

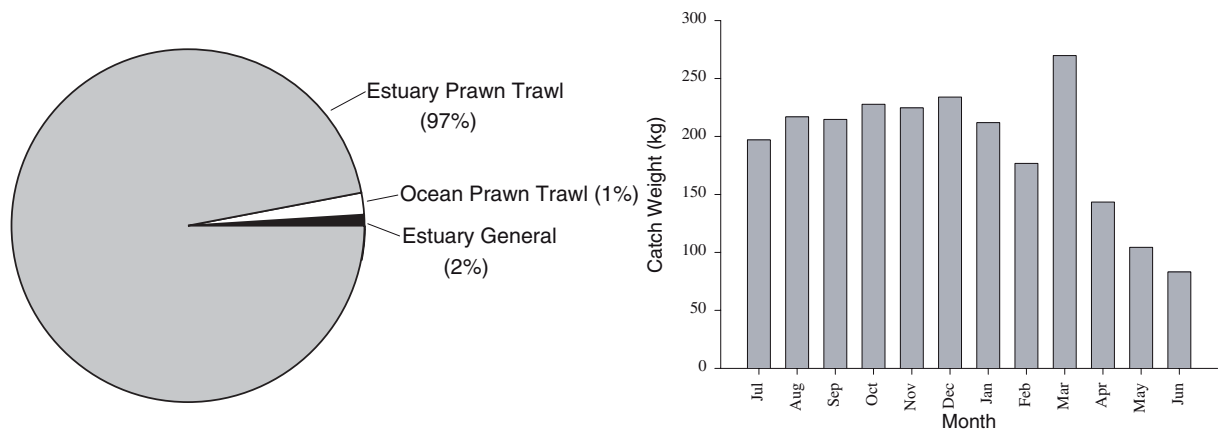


**Figure AB43.** Total annual reported landings (ocean and estuary) of squid for the Hawkesbury River.

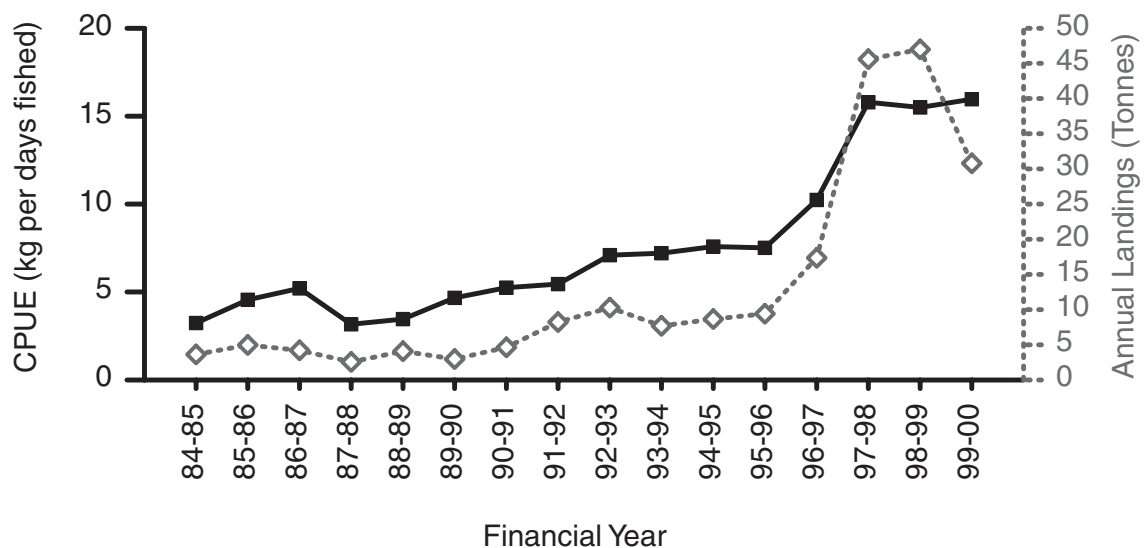
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value of squid amongst all fisheries in the Hawkesbury River have risen in most years since 1986-87 (Figure AB43). However, there has been a

fall in the level of total annual reported landings over the past two years. Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 97% by weight to the total annual reported landings of squid in the Hawkesbury River (Figure AB44(a)). Mean total annual reported landings of squid over the same period in the Estuary Prawn Trawl Fishery in the Hawkesbury River were highest between July and January (inclusive) (Figure AB44(b)). Total annual reported landings were stable at a low level between 1984-85 and 1995-96 but have risen as the fishery for this resource has developed (Figure AB45). Similarly catch rates have risen in most years since 1984-85. (Figure AB45).



**Figure AB44.** The (a) mean proportion contributed by each fishery to the total annual reported landings of squid in the Hawkesbury River and (b) mean monthly reported landings of squid for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery on the Hawkesbury River.



**Figure AB45.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of squid in the Estuary Prawn Trawl Fishery in the Hawkesbury River.

### ***Byproduct species taken in the fishery***

Byproduct species are those that are caught as part of the Estuary Prawn Trawl Fishery and which have significantly contributed traditionally to the marketed catch of the fishery. Those that contributed more than 2% to the total annual reported landings of the fishery of any one estuary between 1997-98 and 1998-99 are described in this section.

**Table AB14.** The byproduct species caught in each estuary by the Estuary Prawn Trawl Fishery.

"Yes" signifies that the species is a byproduct species in that estuary. "No" signifies that the species is not a byproduct species in that estuary.

| Common Name            | Scientific Name                 | Zone       |              |                  |              |                |
|------------------------|---------------------------------|------------|--------------|------------------|--------------|----------------|
|                        |                                 | Botany Bay | Port Jackson | Hawkesbury River | Hunter River | Clarence River |
| Trumpeter Whiting      | <i>Sillago maculata</i>         | Yes        | Yes          | Yes              | No           | No             |
| Greasyback prawns      | <i>Metapenaeus bennettiae</i>   | Yes        | Yes          | Yes              | Yes          | Yes            |
| Tiger prawns           | <i>Penaeus esculentus</i>       | Yes        | Yes          | Yes              | Yes          | Yes            |
| Large-toothed Flounder | <i>Pseudorhombus arsius</i>     | Yes        | Yes          | Yes              | No           | No             |
| Small-toothed Flounder | <i>Pseudorhombus jenynsii</i>   | Yes        | Yes          | Yes              | No           | No             |
| Black Sole             | <i>Synaptura nigra</i>          | No         | No           | Yes              | No           | No             |
| Silverbiddy            | <i>Gerres subfasciatus</i>      | Yes        | Yes          | Yes              | Yes          | Yes            |
| Striped Trumpeter      | <i>Pelates quadrilineatus</i>   | No         | Yes          | Yes              | No           | No             |
| Whitebait              | At least 2 species              | Yes        | No           | Yes              | No           | No             |
| Long-tailed catfish    | <i>Euristhmus lepturus</i>      | No         | No           | Yes              | Yes          | -              |
| Estuary catfish        | <i>Cnidoglanis</i>              | No         | No           | No               | No           | Yes            |
| Striped catfish        | <i>Plotosis lineatus</i>        | No         | Yes          | Yes              | No           | Yes            |
| John Dory              | <i>Zeus faber</i>               | No         | Yes          | No               | No           | No             |
| Bullseyes              | Pempheridae                     | No         | No           | Yes              | No           | No             |
| Hairtail               | <i>Trichiurus lepturus</i>      | No         | No           | Yes              | No           | No             |
| Pike                   | <i>Dinolestes lewini</i>        | No         | No           | Yes              | No           | No             |
| Yellowtail             | <i>Trachurus novaezelandiae</i> | No         | No           | Yes              | No           | No             |
| Sand Crab              | Portunidae                      | Yes        | Yes          | No               | No           | No             |
| Blue Swimmer Crab      | <i>Portunus pelagicus</i>       | Yes        | Yes          | Yes              | No           | Yes            |
| Mud Crab               | <i>Scylla serrata</i>           | No         | Yes          | Yes              | No           | Yes            |
| Octopus                | Unspecified                     | Yes        | Yes          | Yes              | Yes          | No             |
| Mantis Shrimp          | <i>Oratosquilla oratoria</i>    | Yes        | No           | No               | No           | No             |
| Mantis Shrimp          | <i>Erugosquilla grahami</i>     | No         | Yes          | Yes              | No           | No             |
| Mantis Shrimp          | <i>Harpisquilla harpex</i>      | No         | Yes          | Yes              | No           | No             |
| Arrow squid            | <i>Nototodarus gouldi</i>       | Yes        | Yes          | No               | Yes          | Yes            |
| Broad Squid            | <i>Photololigo etheridgei</i>   | Yes        | Yes          | No               | Yes          | Yes            |
| Slender Squid          | Unspecified                     | Yes        | Yes          | No               | Yes          | Yes            |
| Bottle Squid           | <i>Lololus noctiluca</i>        | Yes        | Yes          | No               | Yes          | No             |
| Bubble Squid           | <i>Euprymna stenodactyla</i>    | Yes        | Yes          | Yes              | No           | No             |
| Candy-striped squid    | <i>Sepioloida lineolata</i>     | Yes        | Yes          | Yes              | No           | No             |
| Southern Calamari      | <i>Sepioteuthis australis</i>   | Yes        | Yes          | No               | No           | No             |

### B6.1.5 Trumpeter whiting

### (*Sillago maculata*)

Trumpeter whiting (also known as winter whiting) are distributed along the east coast of Australia. They favour silty, muddy bays and estuaries and inshore waters, and are especially common near river mouths and mangrove creeks. Juvenile trumpeter whiting are found in estuarine seagrasses and shallow habitats, while adults are common in deeper estuarine waters down to depths of 30 m.

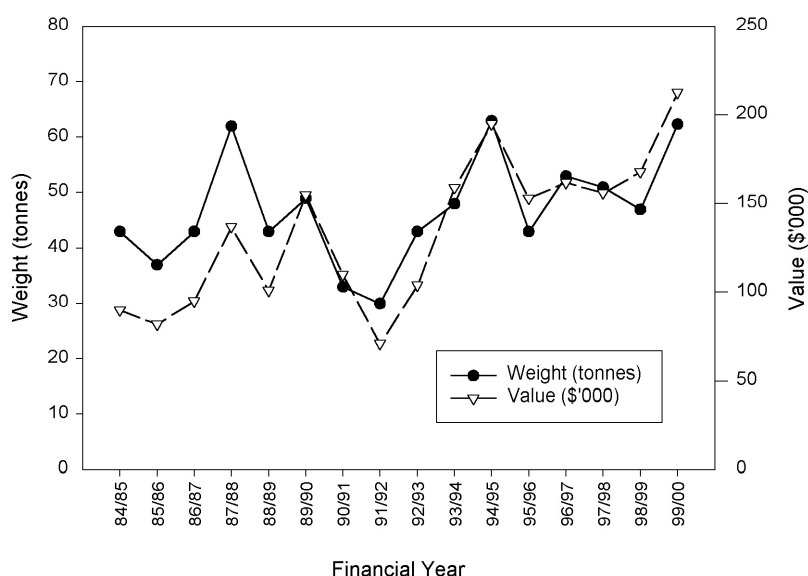
Trumpeter whiting spawn several times throughout the year with peaks in spawning activity from December to February in Botany Bay. They spawn in very shallow water on sandy beaches of sheltered bays and estuaries. Trumpeter whiting grow to about 30 cm total length and reach maturity at about 19 cm fork length (21-22 cm total length). There is a change in sex ratio over size, with more females than males present in adult populations. There are no estimates of maximum age for this species.

Trumpeter whiting forage for burrowing or benthic animals and eat mainly polychaete worms, crustaceans (amphipods, shrimps, crabs), bivalve molluscs and a variety of other benthic animals and small fish.

Trumpeter whiting are caught commercially by haul and seine methods in shallow water (Estuary General Fishery) and by otter trawl in slightly deeper water (Estuary Prawn Trawl Fishery).

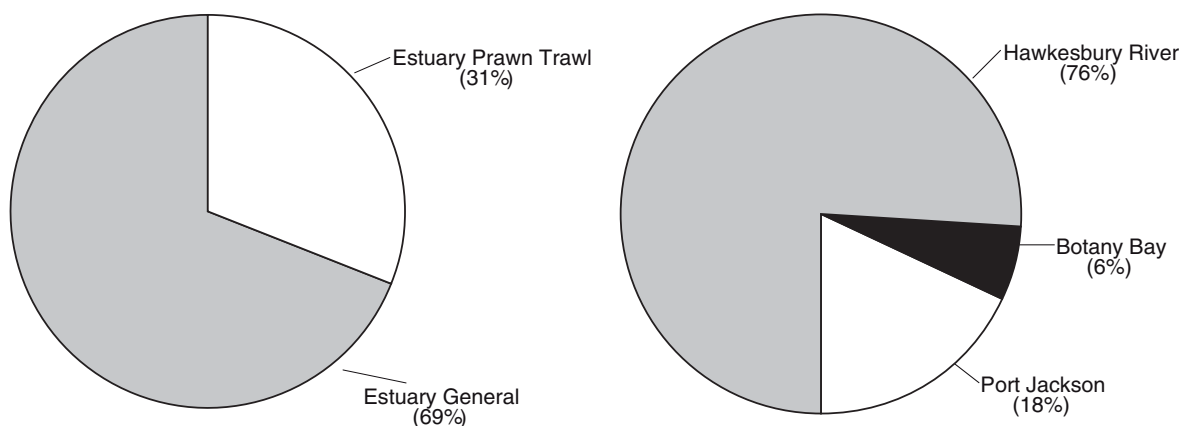
#### *Total annual reported landings for New South Wales*

In 1997-98 and 1998-99, the Estuary General Fishery contributed more than half the total annual reported landings of trumpeter whiting, and the Estuary Prawn Trawl Fishery contributed the rest to the State's total catch of this species (Figure AB47(a)). Total annual reported landings for trumpeter whiting show no consistent pattern. Rather, total annual reported landings have fluctuated about the peak levels of 1987-88 and 1994-95 (Figure AB46). The fishery in the Hawkesbury River contributed most of the landings of the Estuary Prawn Trawl Fishery (Figure AB47(b)).



**Figure AB46.** Total annual reported landings (ocean and estuary) of trumpeter whiting for NSW.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).



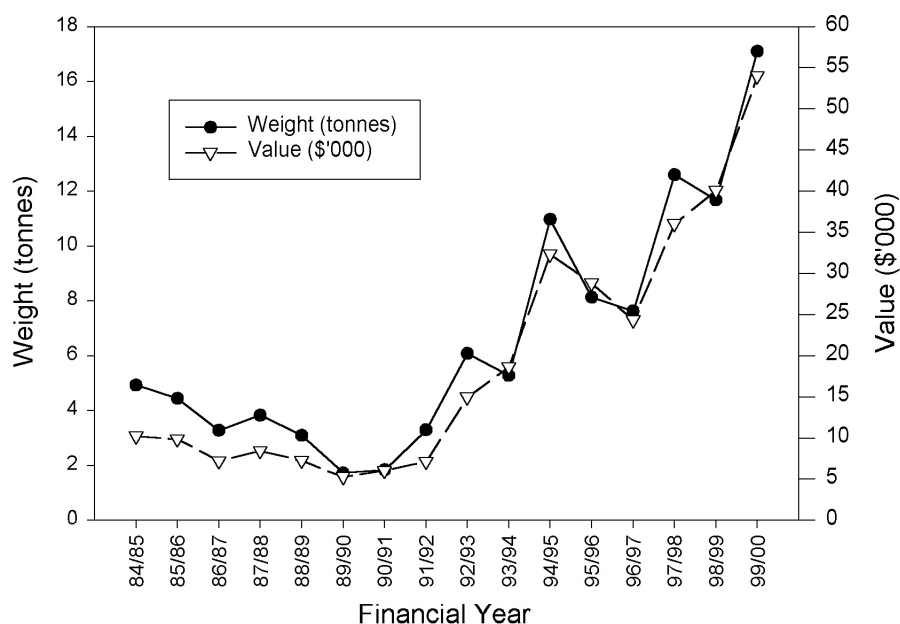
**Figure AB47.** The (a) mean proportion contributed by each fishery to total annual reported landings for 1997-98 and 1998-99 of trumpeter whiting in NSW and (b) mean proportion of total annual reported landings for 1997-98 and 1998-99 of trumpeter whiting from the Estuary Prawn Trawl Fishery contributed by each estuary.

*Total annual reported landings from each Estuary Prawn Trawl Fishery*

The relative contributions each estuary made to the total annual reported landings of trumpeter whiting are shown in Figure AB47(b).

The pattern of total annual reported landings of trumpeter whiting in the Hawkesbury River, Port Jackson and Botany Bay are discussed below because these are the only estuaries of the Estuary Prawn Trawl Fishery where significant quantities of trumpeter whiting are landed by the fishery.

***Hawkesbury River***

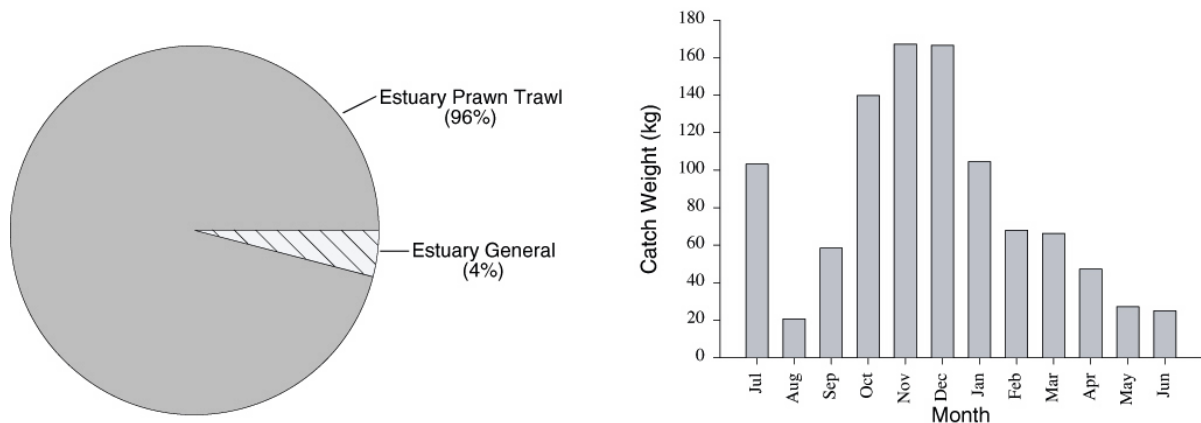


**Figure AB48.** Total annual reported landings (ocean and estuary) of trumpeter whiting for the Hawkesbury River NSW.

(**Note:** Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

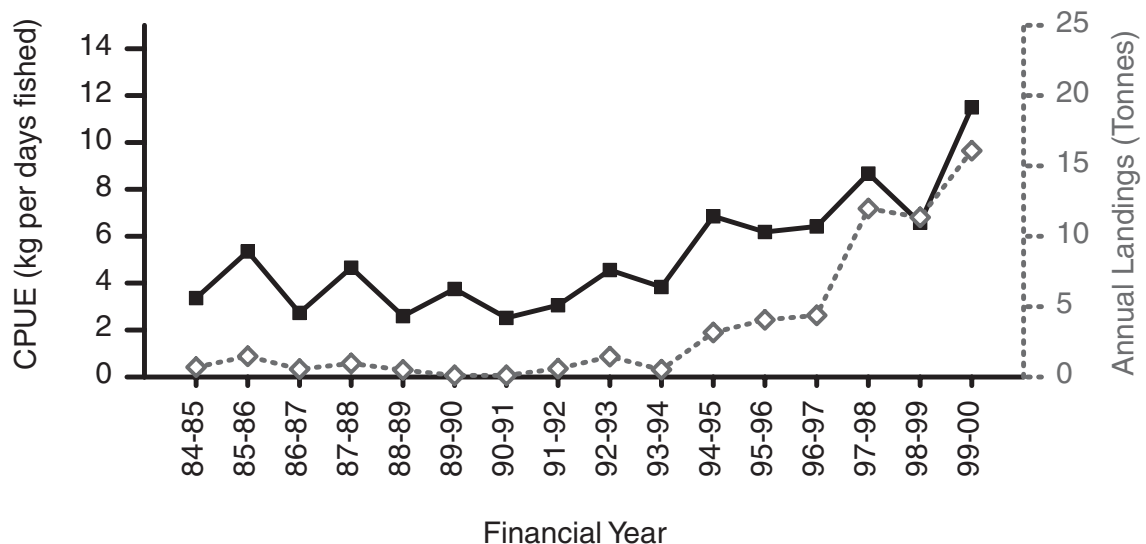


Total annual reported landings by weight and value of trumpeter whiting amongst all fisheries in the Hawkesbury River have steadily risen since 1990-91 (Figure AB48).



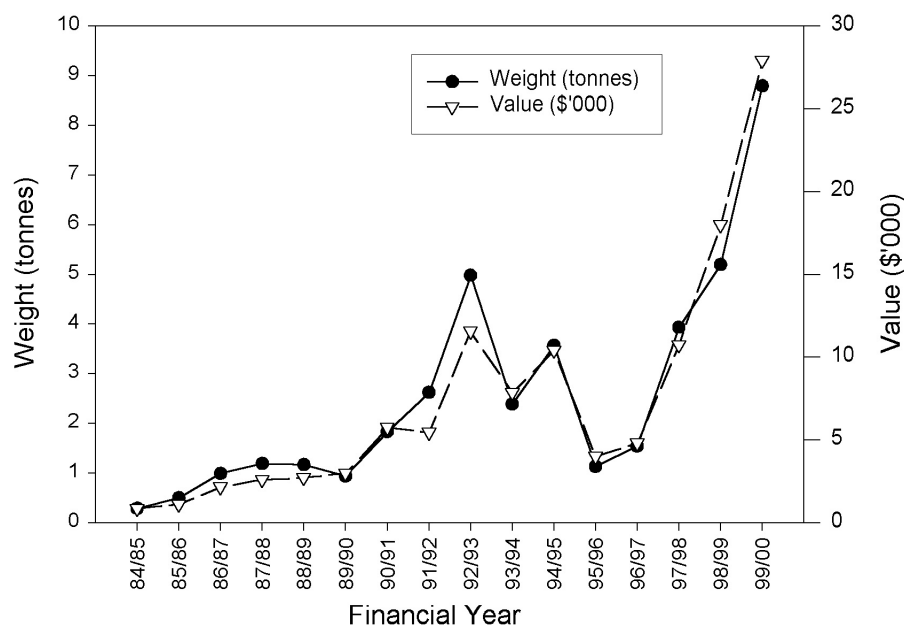
**Figure AB49.** The (a) mean proportion contributed by each fishery to the total annual reported landings of trumpeter whiting in the Hawkesbury River and (b) mean monthly reported landings of trumpeter whiting for 1997-98 and 1998-99 in the Estuary Prawn Trawl Fishery on the Hawkesbury River.

Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 94% by weight to the total annual reported landings for trumpeter whiting from the Hawkesbury River (Figure AB49(a)). Mean total annual reported landings of trumpeter whiting over the same period in the Estuary Prawn Trawl Fishery in the Hawkesbury River were highest between October and December (inclusive) (Figure AB49(b)). Total annual reported landings for the Estuary Prawn Trawl Fishery in the Hawkesbury River were stable at a low level between 1984-85 and 1996-97 but have since risen. (Figure AB50). Catch rates remained stable between 1984-85 and 1993-94, then rose in 1994-95 and have remained at around this level since then (Figure AB50).



**Figure AB50.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of trumpeter whiting in the Estuary Prawn Trawl Fishery in the Hawkesbury River.

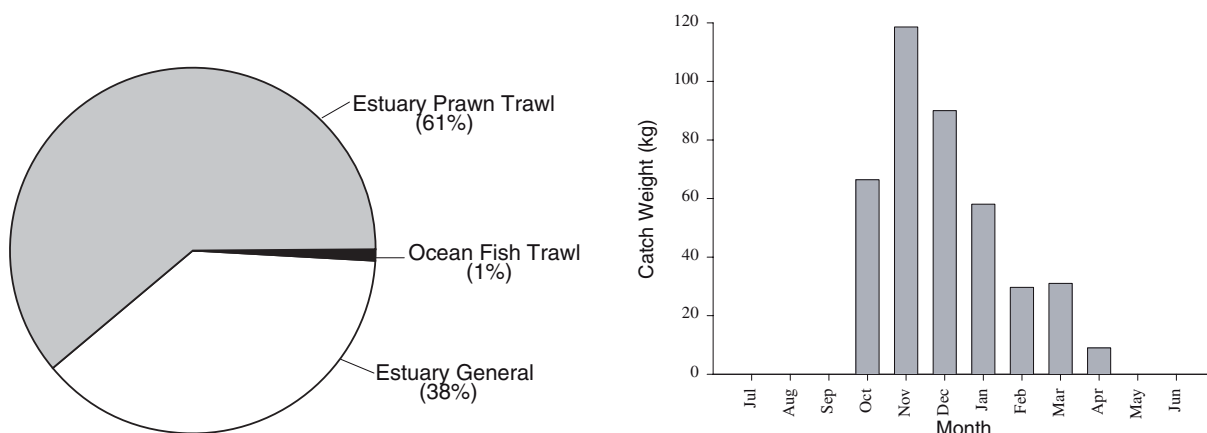
### Port Jackson



**Figure AB51.** Total annual reported landings (ocean and estuary) of trumpeter whiting for Port Jackson.

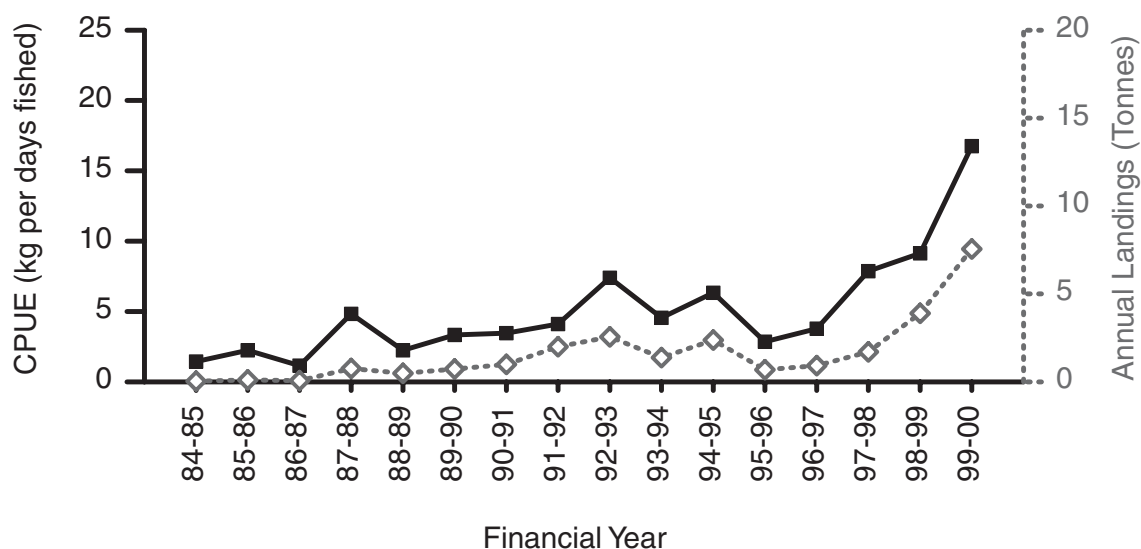
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value of trumpeter whiting amongst all fisheries in Port Jackson have risen in most years (Figure AB51).



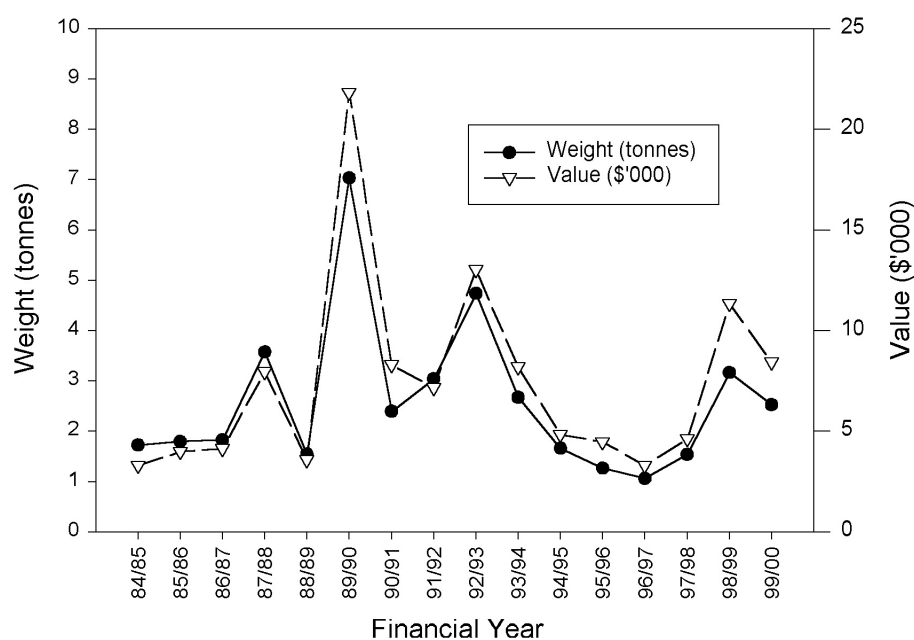
**Figure AB52.** The (a) mean proportion contributed by each fishery to the total annual reported landings of trumpeter whiting in Port Jackson and (b) mean monthly reported landings of trumpeter whiting for 1997-98 and 1998-99 by the Estuary Prawn Trawl Fishery in Port Jackson.

Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 61% by weight to the total annual reported landings of trumpeter whiting from Port Jackson (Figure AB52(a)). The mean total annual reported landings of trumpeter whiting over the same period in the Estuary Prawn Trawl Fishery in Port Jackson were highest between November and December (Figure AB52(b)). Total annual reported landings and catch rates for the Estuary Prawn Trawl Fishery in Port Jackson remained at low levels until 1995-96 but have risen since then (Figure AB53).



**Figure AB53.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of trumpeter whiting in the Estuary Prawn Trawl Fishery in Port Jackson.

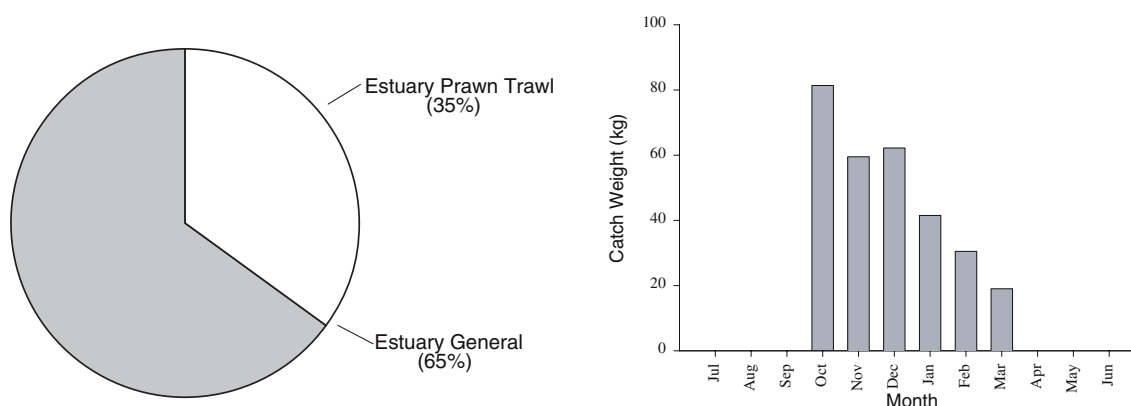
### *Botany Bay*



**Figure AB54.** Total annual reported landings (ocean and estuary) of trumpeter whiting for Botany Bay.

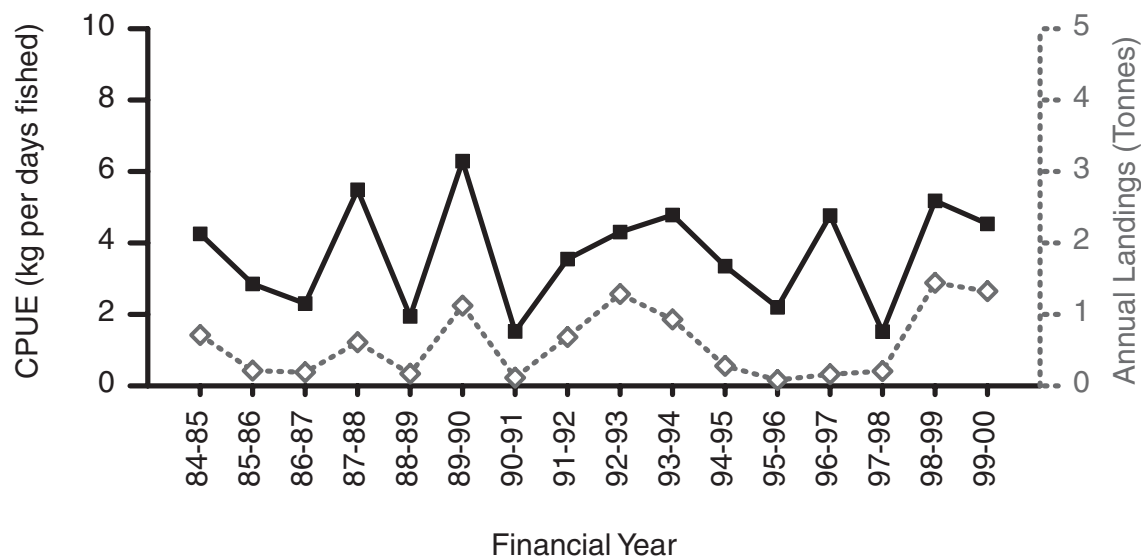
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value of trumpeter whiting amongst all fisheries in Botany Bay were high in 1989-90 and 1992-93, then fell in all years until 1996-97 (Figure AB54), and have risen since (Figure AB54).



**Figure AB55.** The (a) mean proportion contributed by each fishery to the total annual reported landings of trumpeter whiting in Botany Bay and (b) mean monthly reported landings of trumpeter whiting for 1997-98 and 1998-99 by the Estuary Prawn Trawl Fishery in Botany Bay.

Over the period 1997-98 and 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 35% by weight to the total annual reported landings of trumpeter whiting from Botany Bay (Figure AB55(a)). Mean total annual reported landings of trumpeter whiting over the same period in the Estuary Prawn Trawl Fishery in Botany Bay were highest between October and December (inclusive) (Figure AB55(b)). Total annual reported landings and catch rates for the Estuary Prawn Trawl Fishery have fluctuated (Figure AB56).



**Figure AB56.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of trumpeter whiting in the Estuary Prawn Trawl Fishery in Botany Bay.

## Blue swimmer crab (*Portunus pelagicus*)

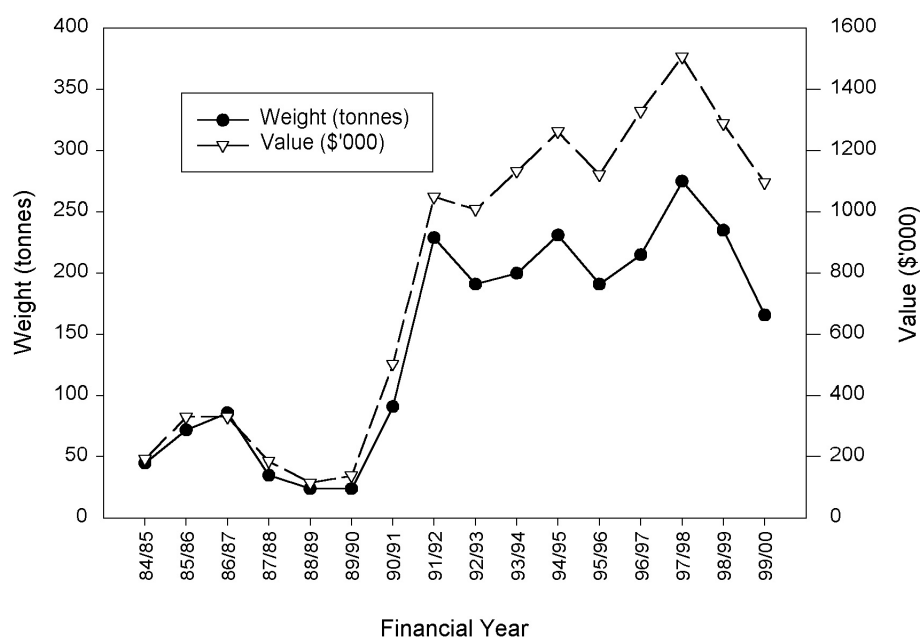
The blue swimmer crab (*Portunus pelagicus*) inhabits coastal waters in all Australian states except Tasmania and Victoria, and is also widely distributed throughout the Indo-Pacific region. In NSW waters, blue swimmer crabs are found primarily within the lower estuarine and inshore coastal waters. Within estuaries, they are found in association with mud, sand and seagrass, and are often buried in the sediment. Blue swimmer crabs mostly prey on slow-moving invertebrates such as bivalve molluscs, crustaceans and worms, but also scavenge on material including dead fish and squid.

Information contained in studies of blue swimmer crabs in South Australia and Western Australia, suggest that this species are likely to spawn in both lower estuarine and ocean waters, with peak spawning expected in spring or summer (Kumar 1997). The larvae may drift well out to sea before settling in shallow estuarine or inshore waters, in areas similar to those inhabited by adults. Blue swimmer crabs grow to sizes around 200 mm (carapace width) and live for up to three years. Size at maturity is variable, but based on studies from other states, is likely to be around 90 mm in NSW (i.e. at about one year of age).

Blue swimmer crabs are a target species in the Estuary General Fishery and are caught as a byproduct species in the Estuary Prawn Trawl Fishery. There is a small export market for blue swimmer crabs, but the majority of crabs are sold whole cooked or uncooked in local markets.

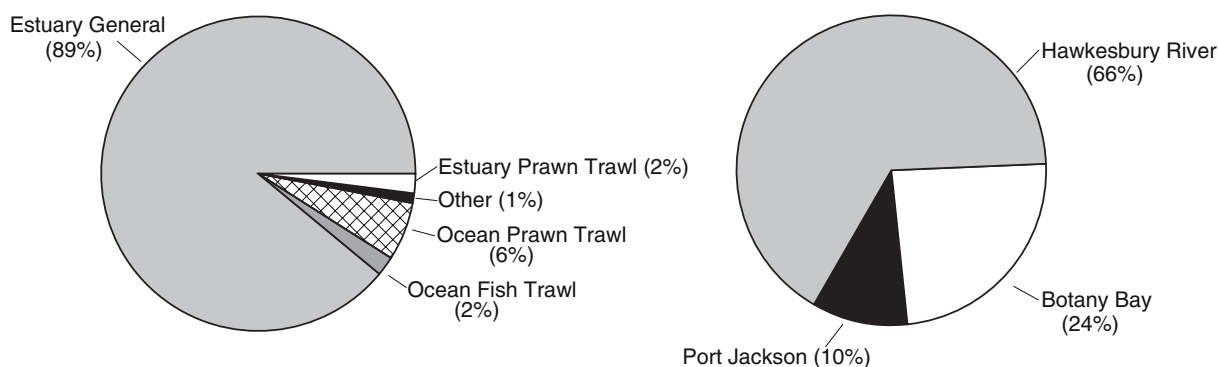
### *Total annual reported landings for New South Wales*

Total annual reported landings rose from 1989-90 to 1991-92, remained stable around this high level until 1998-99, but have fallen over the past two years (Figure AB57). The Estuary General Fishery contributed by far the most to the total annual reported landings of blue swimmer crabs during 1997-98 to 1998-99 (inclusive), with that from the Estuary Prawn Trawl Fishery being only minor (Figure AB58(a)). The fishery in the Hawkesbury River contributed most of the landings by the Estuary Prawn Trawl Fishery (Figure AB58(b)).



**Figure AB57.** Total annual reported landings (ocean and estuary) of blue swimmer crab for NSW.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

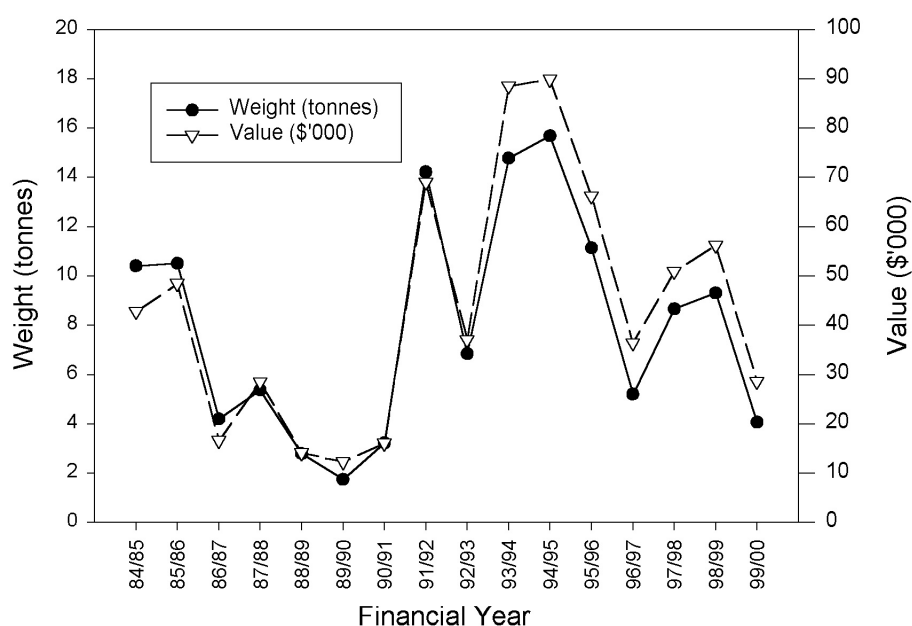


**Figure AB58.** The (a) mean proportion contributed by each fishery to total annual reported landings for 1997-98 and 1998-99 of blue swimmer crab in NSW and (b) mean proportion of total annual reported landings for 1997-98 and 1998-99 of blue swimmer crab from the Estuary Prawn Trawl Fishery contributed by each estuary.

*Total annual reported landings from each estuary in the Estuary Prawn Trawl Fishery*

The relative contributions each estuary made to the total annual reported landings of blue swimmer crabs are shown in Figure AB58(b). The pattern of total annual reported landings of blue swimmer crabs in the Hawkesbury River, Port Jackson and Botany Bay are discussed below because these are the only estuaries of the Estuary Prawn Trawl Fishery where significant quantities of blue swimmer crabs are landed by the fishery.

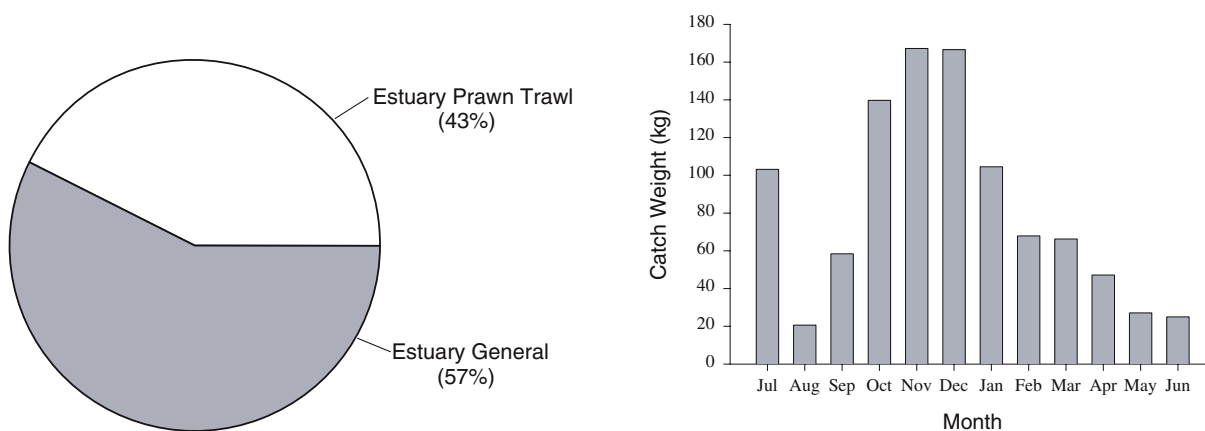
***Hawkesbury River***



**Figure AB59.** Total annual reported landings (ocean and estuary) of blue swimmer crab for the Hawkesbury River.

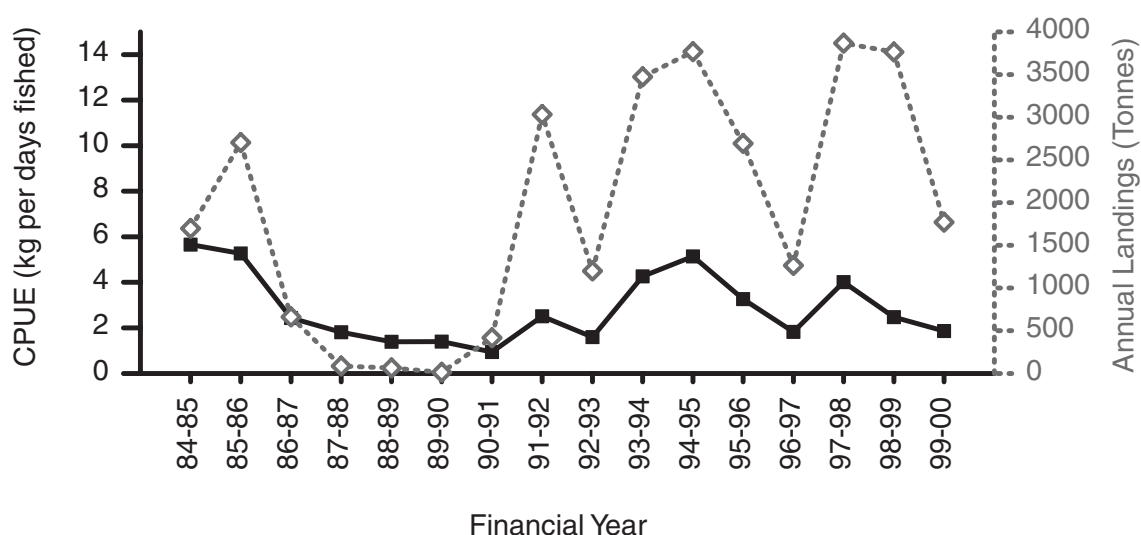
(**Note:** Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value of blue swimmer crabs amongst all fisheries in the Hawkesbury River have fluctuated greatly but have fallen since the high of 1994-95 (Figure AB59).



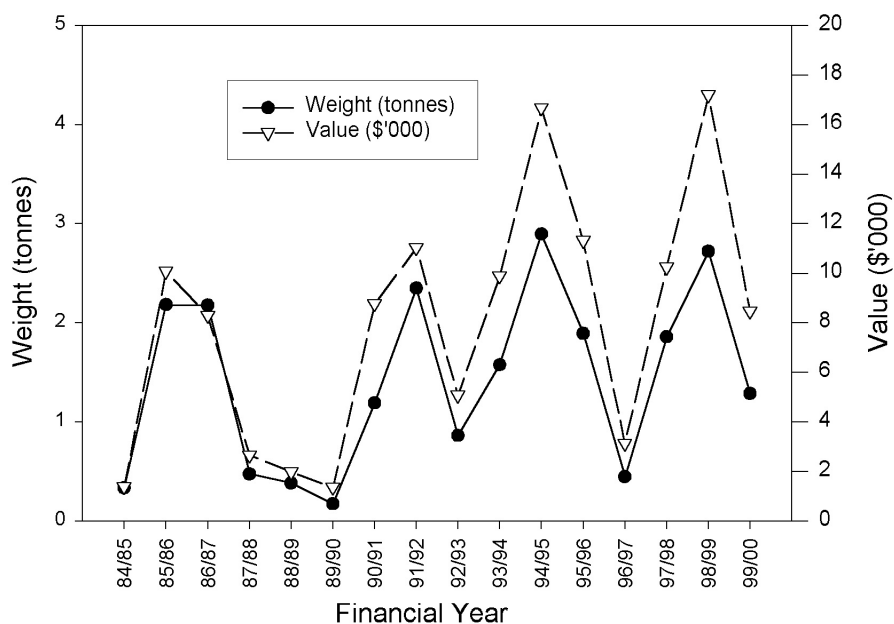
**Figure AB60.** The (a) mean proportion contributed by each fishery to the total annual reported landings of blue swimmer crab in the Hawkesbury River and (b) mean monthly reported landings for 1997-98 and 1998-99 of blue swimmer crab by the Estuary Prawn Trawl Fishery in the Hawkesbury River.

Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 43% by weight to the total annual reported landings for blue swimmer crabs from the Hawkesbury River (Figure AB60(a)). Mean total annual reported landings of blue swimmer crabs over the same period in the Estuary Prawn Trawl Fishery in the Hawkesbury River were highest between October and December (inclusive) (Figure AB60(b)). Total annual reported landings for the Estuary Prawn Trawl Fishery in the Hawkesbury River again have fluctuated but in an upward pattern since 1990-91 (Figure AB61). Catch rates fell from 1984-85 until 1990-91 and have fluctuated since then (Figure AB61).



**Figure AB61.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of blue swimmer crab in the Estuary Prawn Trawl Fishery in the Hawkesbury River.

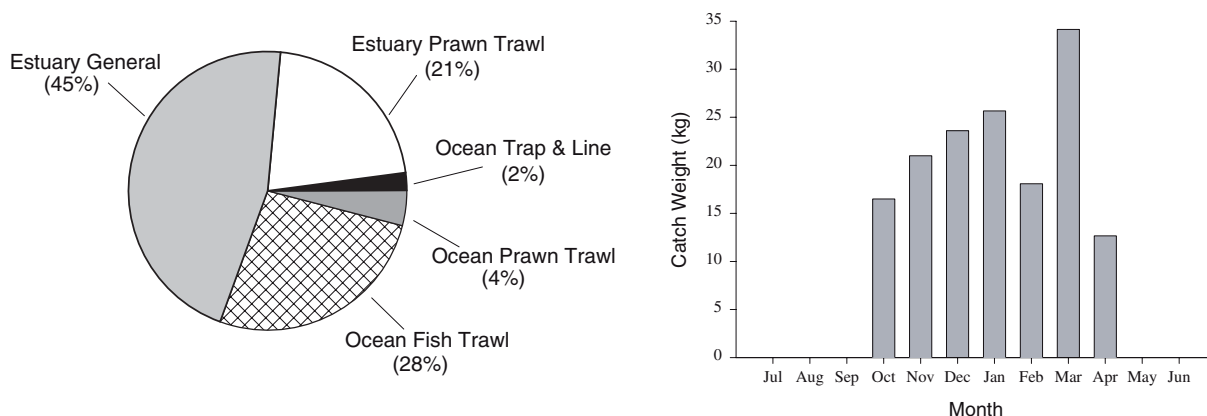
## Port Jackson



**Figure AB62.** Total annual reported landings (ocean and estuary) of blue swimmer crab for Port Jackson.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

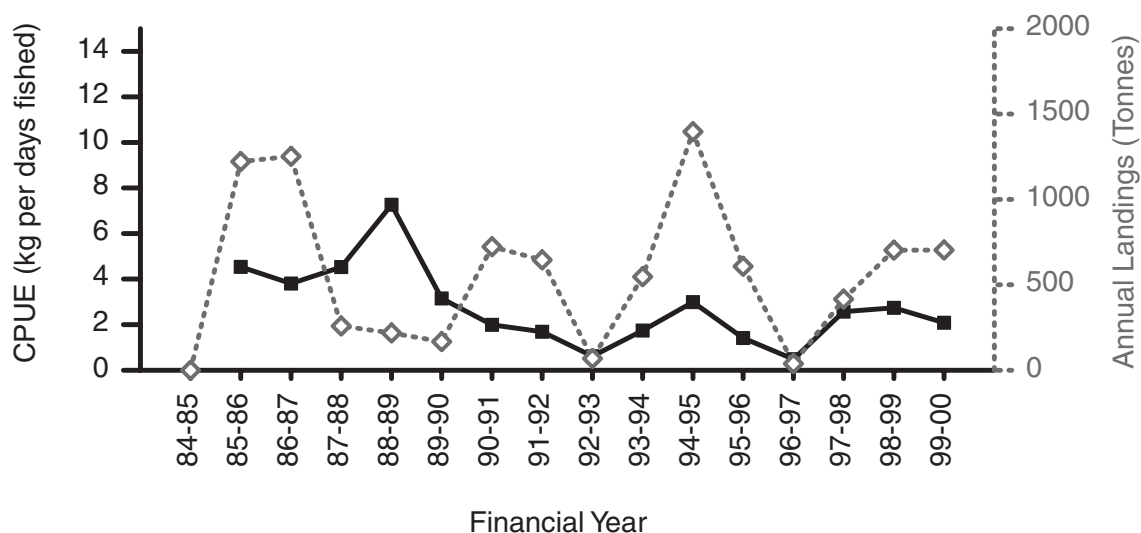
Total annual reported landings by weight and value of blue swimmer crabs amongst all fisheries in Port Jackson have fluctuated (Figure AB62).



**Figure AB63.** The (a) mean proportion contributed by each fishery to the total annual reported landings of blue swimmer crab in Port Jackson and (b) mean monthly reported landings of blue swimmer crab for 1997-98 and 1998-99 by the Estuary Prawn Trawl Fishery in Port Jackson.

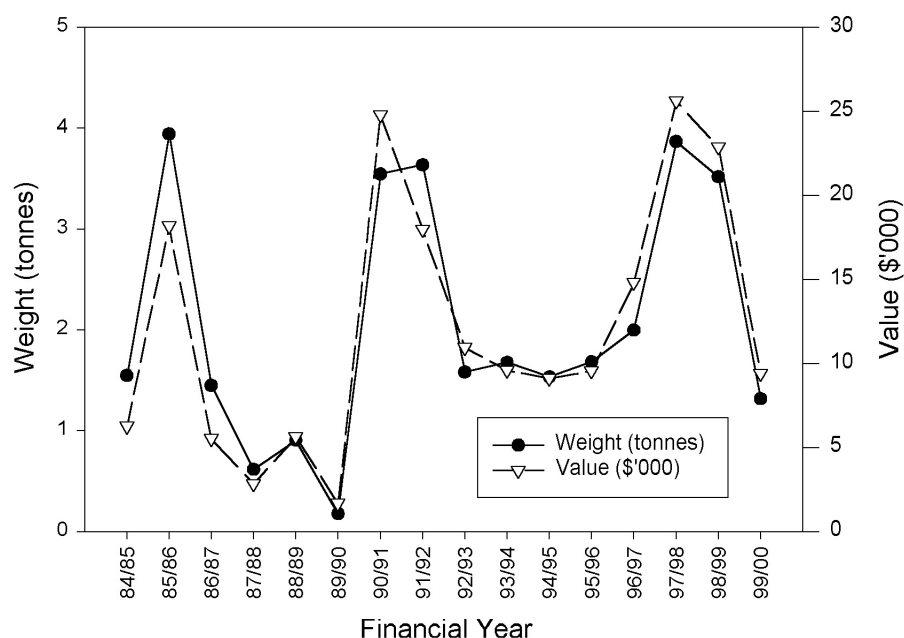


Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 21% by weight to the total annual reported landings for blue swimmer crabs from Port Jackson (Figure AB63(a)). Mean total annual reported landings of blue swimmer crabs over the same period in the Estuary Prawn Trawl Fishery in Port Jackson were highest in March (Figure AB63(b)). Total annual reported landings for the Estuary Prawn Trawl Fishery in Port Jackson have fluctuated (Figure AB64). Catch rates show an overall downward trend (Figure AB64).



**Figure AB64.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of blue swimmer crab in the Estuary Prawn Trawl Fishery in Port Jackson.

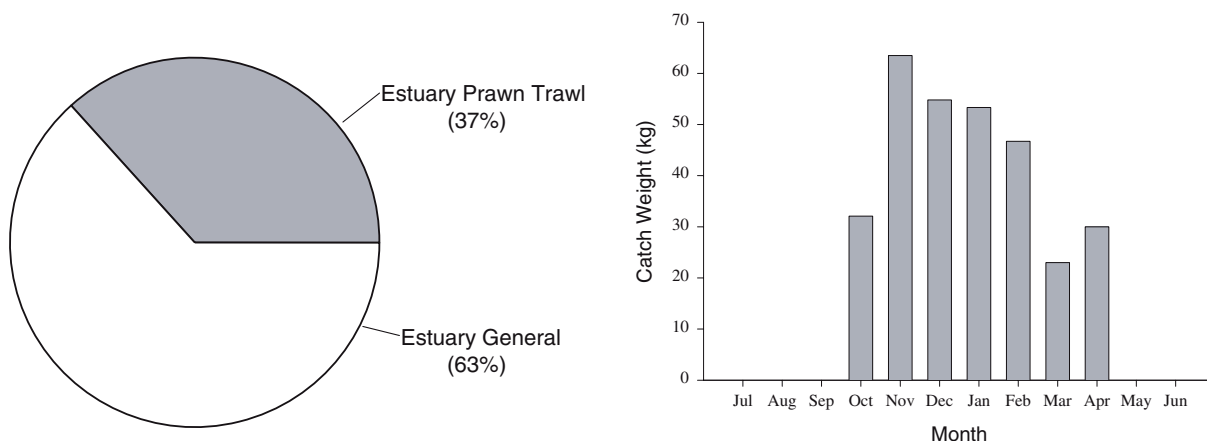
### *Botany Bay*



**Figure AB65.** Total annual reported landings (ocean and estuary) of blue swimmer crab for Botany Bay.

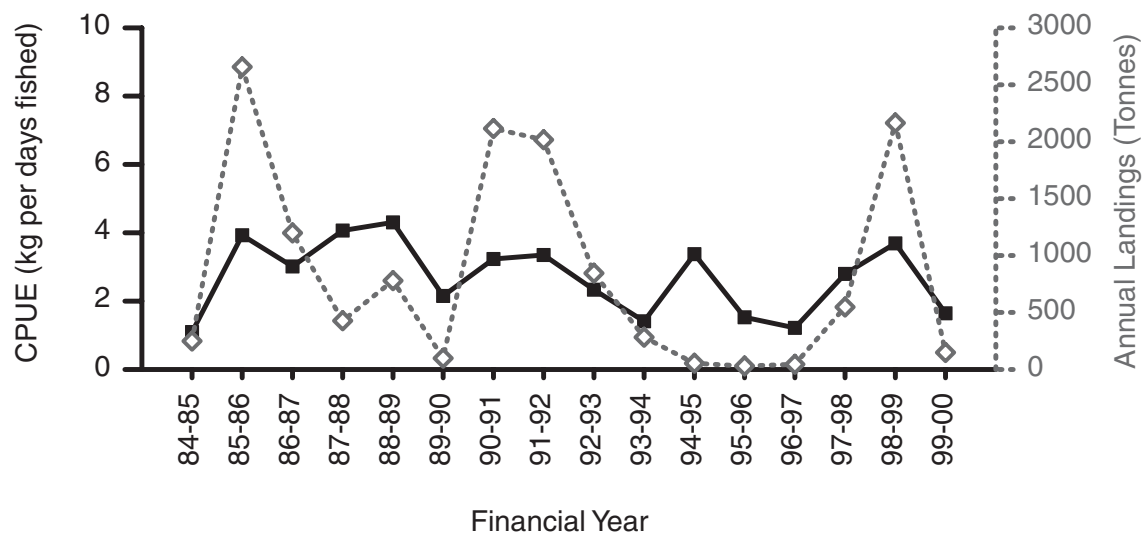
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value for blue swimmer crabs amongst all fisheries in Botany Bay have fluctuated (Figure AB65).



**Figure AB66.** The (a) mean proportion contributed by each fishery to the total annual reported landings of blue swimmer crab in Botany Bay and (b) mean monthly reported landings of blue swimmer crab for 1997-98 and 1998-99 by the Estuary Prawn Trawl Fishery in Botany Bay.

Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 37% by weight to the total annual reported landings for blue swimmer crabs from Botany Bay (Figure AB66(a)). Mean total annual reported landings of blue swimmer crabs over the same period in the Estuary Prawn Trawl Fishery in Botany Bay were highest between November and February (inclusive) (Figure AB66(b)). Total annual reported landings for the Estuary Prawn Trawl Fishery in Botany Bay have fluctuated (Figure AB67). Catch rates have also fluctuated but overall, have remained relatively stable (Figure AB67).



**Figure AB67.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of blue swimmer crab in the Estuary Prawn Trawl Fishery in Botany Bay.

## Silver biddy (*Gerres subfasciatus*)

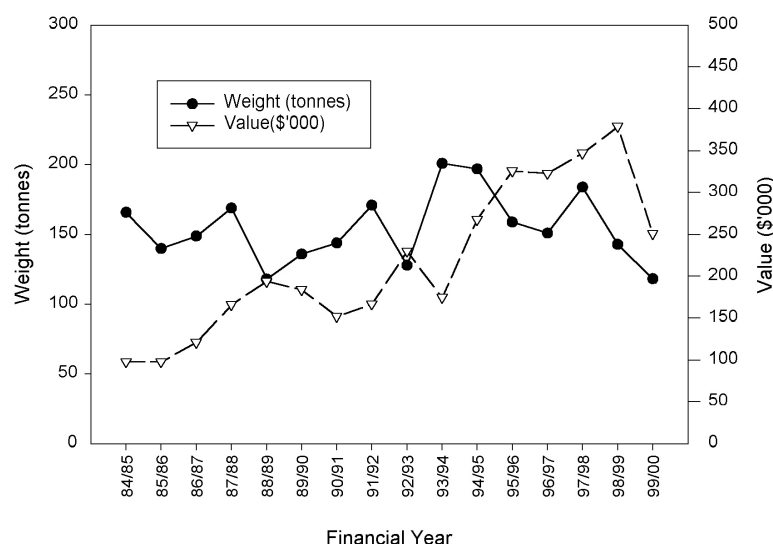
The silver biddy (*Gerres subfasciatus*) is widely distributed, occurring on both the east and west coasts of Australia. In NSW waters, silver biddies are found in both estuaries and inshore, ocean waters. Within estuaries, they are generally found over sand and mud bottoms. Their diet consists of small invertebrates, particularly polychaetes.

Spawning appears to occur primarily during summer and early autumn within both inshore ocean waters and waters of marine characteristics within estuaries. The larvae enter estuaries and the small juveniles subsequently live in sheltered, shallow water habitats (particularly where cover such as seagrass or algae are available). Larger juveniles appear to be less dependent upon such cover, and are found over open bare substrate. Silver biddies are thought to mature at around 200 mm in total length (TL) and they grow to a maximum length of around 230 mm (TL). Little is known about their rates of growth or patterns of movement.

Silver biddies are one of the smallest finfish commercially harvested in NSW. The species is similar in appearance to small bream, and this is often the catalyst for public concern as people observe commercial fishing operations catching what they think are many small bream or see these small fish in shop windows. Prior to the 1980s silver biddies were landed in small quantities by commercial hauling operations and were sold as an incidental catch because of their relative low value. As prices began to rise, quantities of this previously discarded species were retained for sale.

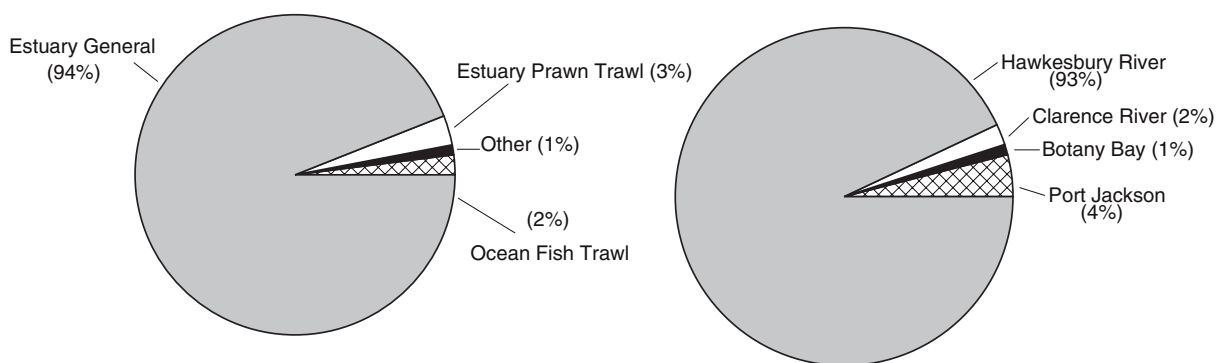
### *Total annual reported landings for New South Wales*

Total annual reported landings have fluctuated over the period for which data are available, but overall, have remained stable. Value has risen because of increases in prices (Figure AB68). The Estuary General Fishery contributed by far the most to the total annual reported landings of silver biddies during 1997-98 to 1998-99 (inclusive), with that from the Estuary Prawn Trawl Fishery being only minor (Figure AB69(a)). The fishery in the Hawkesbury River contributed nearly all the landings by the Estuary Prawn Trawl Fishery (Figure AB69(b)).



**Figure AB68.** Total annual reported landings (ocean and estuary) of silver biddy for NSW.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

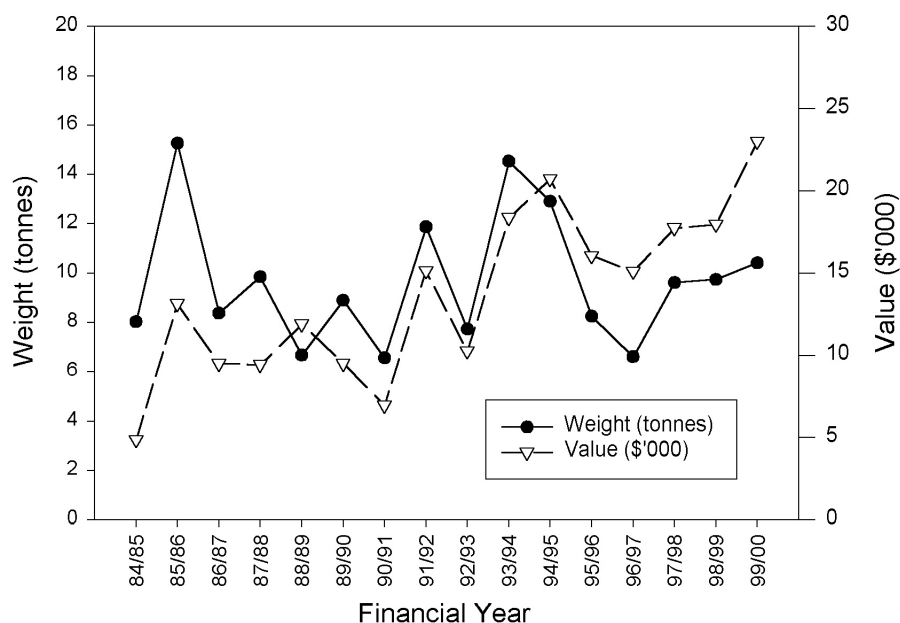


**Figure AB69.** The (a) mean proportion contributed by each fishery to total annual reported landings for 1997-98 and 1998-99 of silver biddy in NSW and (b) mean proportion of total annual reported landings for 1997-98 and 1998-99 of silver biddy from the Estuary Prawn Trawl Fishery contributed by each estuary.

#### *Total annual reported landings from each Estuary Prawn Trawl Fishery*

The pattern of total annual reported landings of silver biddys in the Hawkesbury River and Port Jackson are discussed below, but the fishery in the Hawkesbury River contributes by far the most to the landings of silver biddys by the Estuary Prawn Trawl Fishery (Figure AB68(b)).

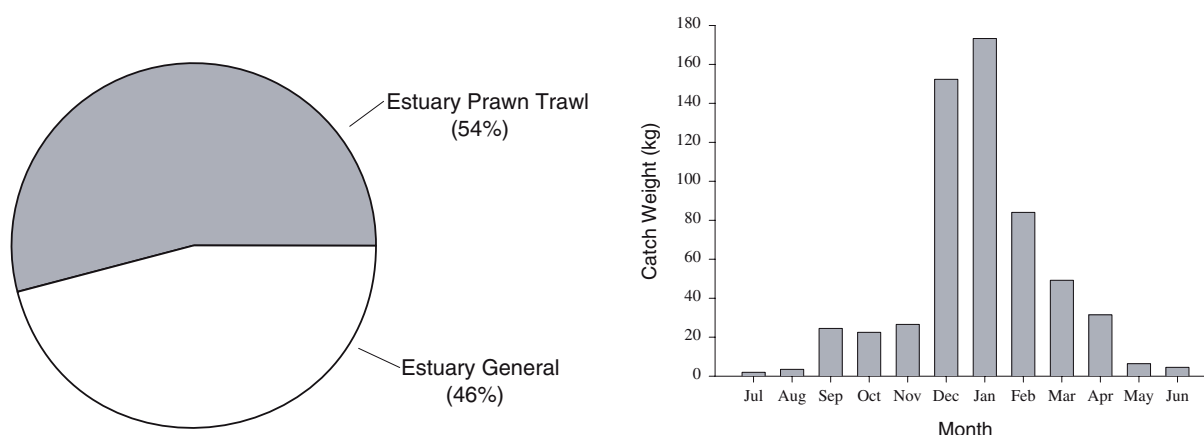
#### ***Hawkesbury River***



**Figure AB70.** Total annual reported landings (ocean and estuary) of silver biddy for the Hawkesbury River.

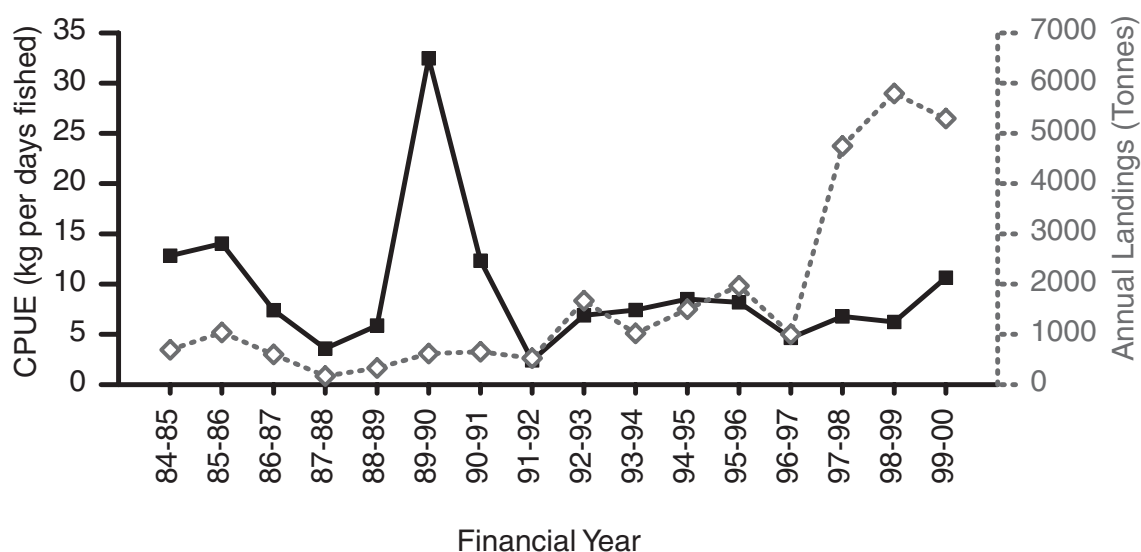
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight of silver biddy amongst all fisheries in the Hawkesbury River have fluctuated about a stable level (Figure AB70). The value of the landings has fluctuated but with an upward pattern since 1990-91.



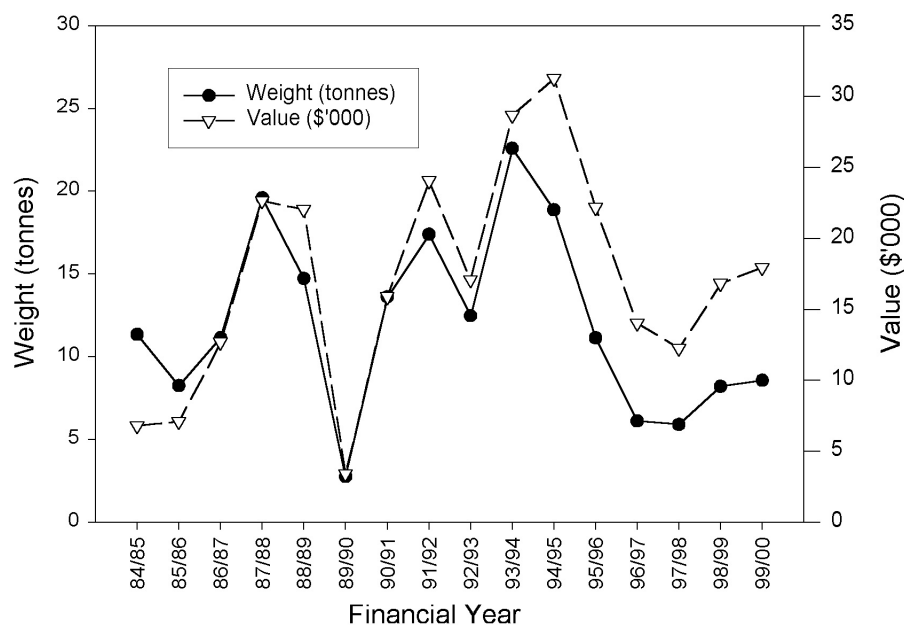
**Figure AB71.** The (a) mean proportion contributed by each fishery to the total annual reported landings of silver biddy in the Hawkesbury River and (b) mean monthly reported landings of silver biddy for 1997-98 and 1998-99 by the Estuary Prawn Trawl Fishery in the Hawkesbury River.

Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 54% by weight to the total annual reported landings of silver biddy from the Hawkesbury River (Figure AB71(a)). Mean total annual reported landings of silver biddy over the same period in the Estuary Prawn Trawl Fishery in the Hawkesbury River were highest in December and January (Figure AB71(b)). Total annual reported landings for the Estuary Prawn Trawl Fishery in the Hawkesbury River have risen slowly in most years since 1987-88 (Figure AB72). Catch rates have remained relatively stable over the period since 1984-85 (Figure AB72).



**Figure AB72.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of silver biddy in the Estuary Prawn Trawl Fishery in the Hawkesbury River.

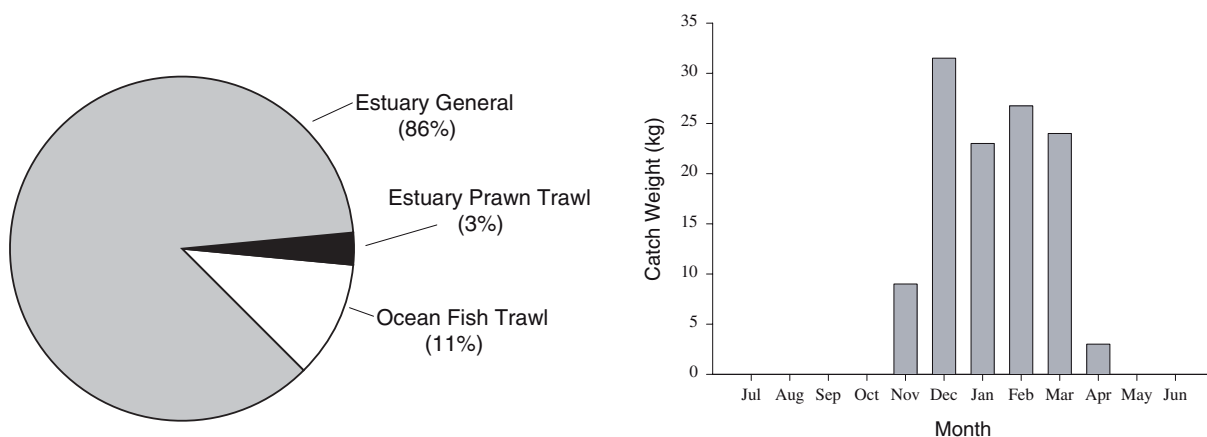
### Port Jackson



**Figure AB73.** Total annual reported landings (ocean and estuary) of silver biddy for Port Jackson.

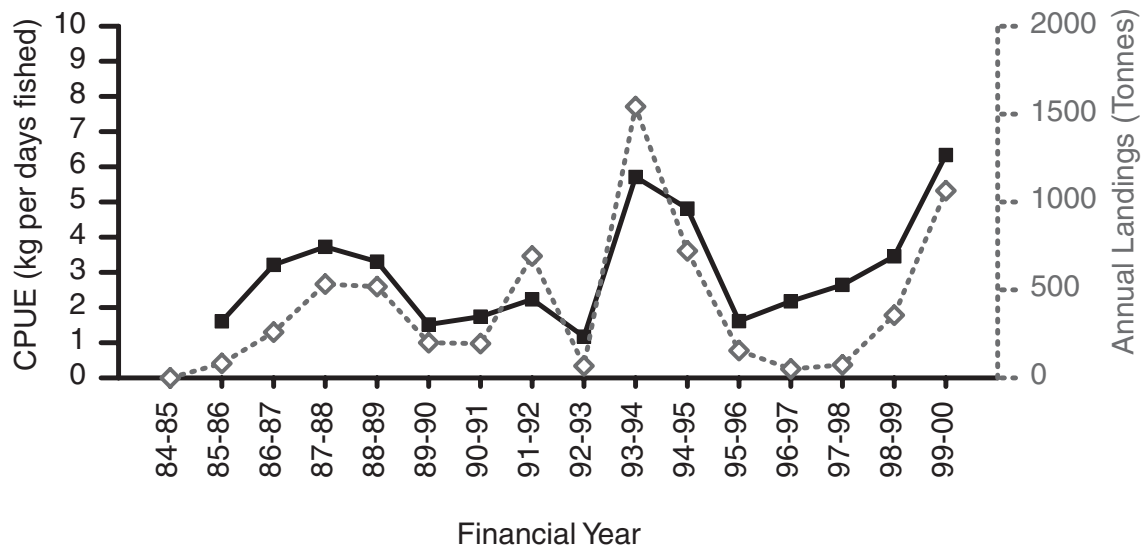
(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

Total annual reported landings by weight and value for silver biddy from Port Jackson have fluctuated (Figure AB73).



**Figure AB74.** The (a) mean proportion contributed by each fishery to the total annual reported landings of silver biddy in Port Jackson and (b) mean monthly reported landings of silver biddy by the Estuary Prawn Trawl Fishery in Port Jackson. The years used in (a) and (b) above are 1997-98 and 1998-99.

Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 3% by weight to the total annual reported landings for silver biddy from Port Jackson (Figure AB74(a)). Mean total annual reported landings of silver biddy over the same period in the Estuary Prawn Trawl Fishery in Port Jackson were highest between December and March (inclusive) (Figure AB74(b)). Total annual reported landings for the Estuary Prawn Trawl Fishery in Port Jackson show no consistent pattern but have risen over the past two years (Figure AB75). Catch rates fluctuated until 1995-96, but have risen in each year since then (Figure AB75).



**Figure AB75.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of silver biddy in the Estuary Prawn Trawl Fishery in Port Jackson.

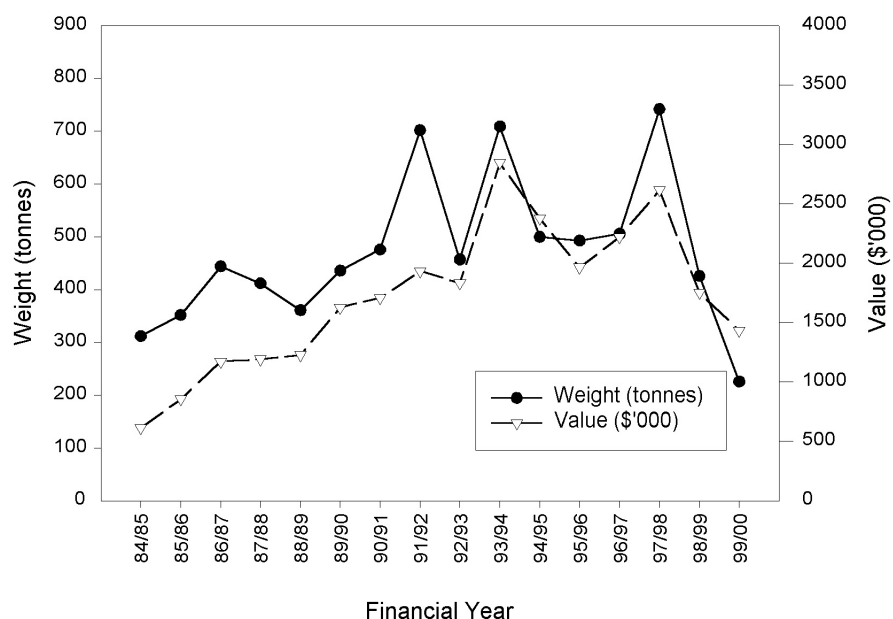
## Octopus species

*Octopus tetricus*, other wise known as the gloomy octopus or the common Sydney octopus, is the main species of octopus caught in the Estuary Prawn Trawl Fishery.

This species is endemic to Australian waters and is common in the seagrass beds and coastal reefs along the eastern and western coasts of the continent from Brisbane to Eden on the east coast, and from Albany to Exmouth Gulf on the west coast. Gloomy octopus grow to 80 cm in total length (mantle length 16cm) and weigh up to 3 kg. Males mature at 100-150 g weight with females being larger at maturity. A 2.1 kg female will produce one brood of up to 150 000 eggs, usually laid in darkness over a period of several days. The female octopus dies after all the eggs have hatched 4 to 9 weeks later. The eggs hatch into small free-swimming young which are carried in the plankton.

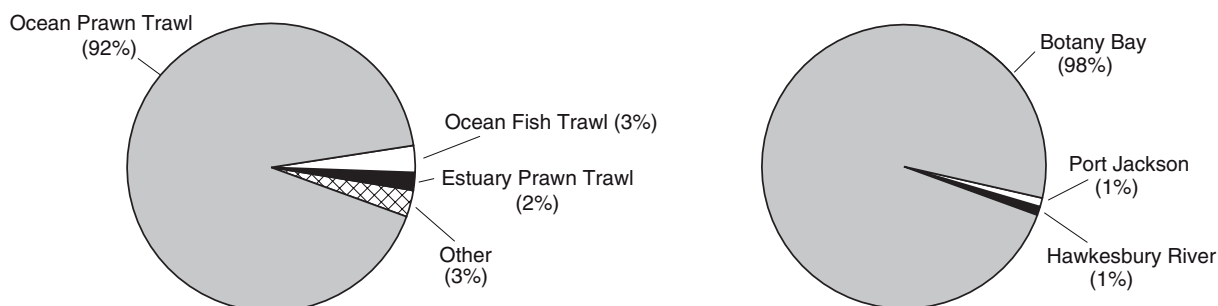
### *Total annual reported landings for New South Wales*

Total annual reported landings rose from 1984-85 to 1998-99, but have fallen over the last two years. Value rose until 1993-94 and has fallen in most years since then (Figure AB76). The Ocean Prawn Trawl Fishery contributed by far the most to the total annual reported landings of octopus during 1997-98 to 1998-99 (inclusive), with that from the Estuary Prawn Trawl Fishery being only minor (Figure AB77(a)). The fishery in Botany Bay contributed most of the landings by the Estuary Prawn Trawl Fishery (Figure AB77(b)).



**Figure AB76.** Total annual reported landings (ocean and estuary) of octopus for NSW.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

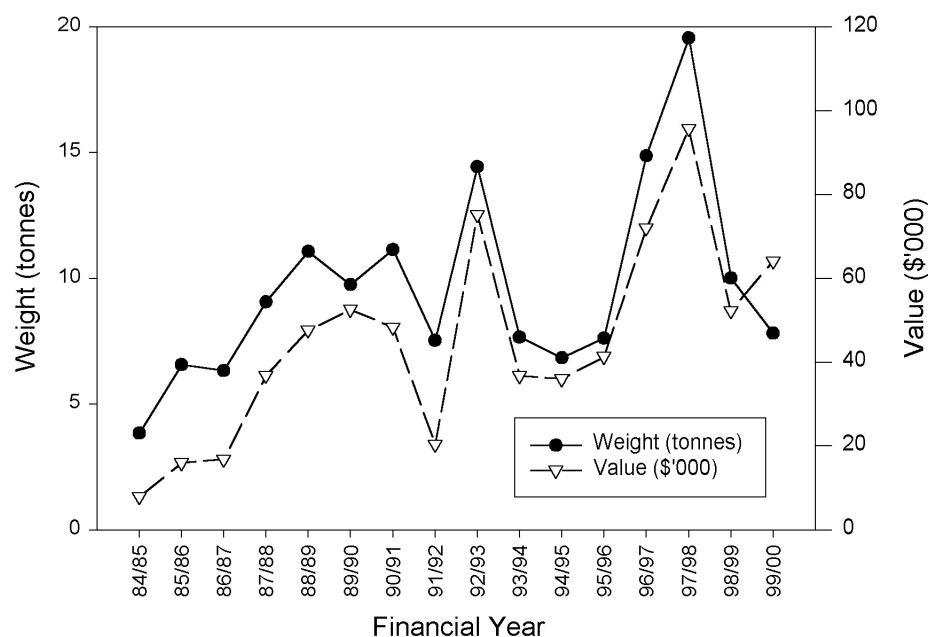


**Figure AB77.** The (a) mean proportion contributed by each fishery to total annual reported landings for 1997-98 and 1998-99 of octopus in NSW and (b) mean proportion of total annual reported landings for 1997-98 and 1998-99 of octopus from the Estuary Prawn Trawl Fishery contributed by each estuary.

*Total annual reported landings from each Estuary Prawn Trawl Fishery*

The relative contributions each estuary made to the total annual reported landings of octopus are shown in Figure AB77(b). Botany Bay is the only estuary of the Estuary Prawn Trawl Fishery discussed here because it contributed nearly all of the landings of octopus in the fishery.

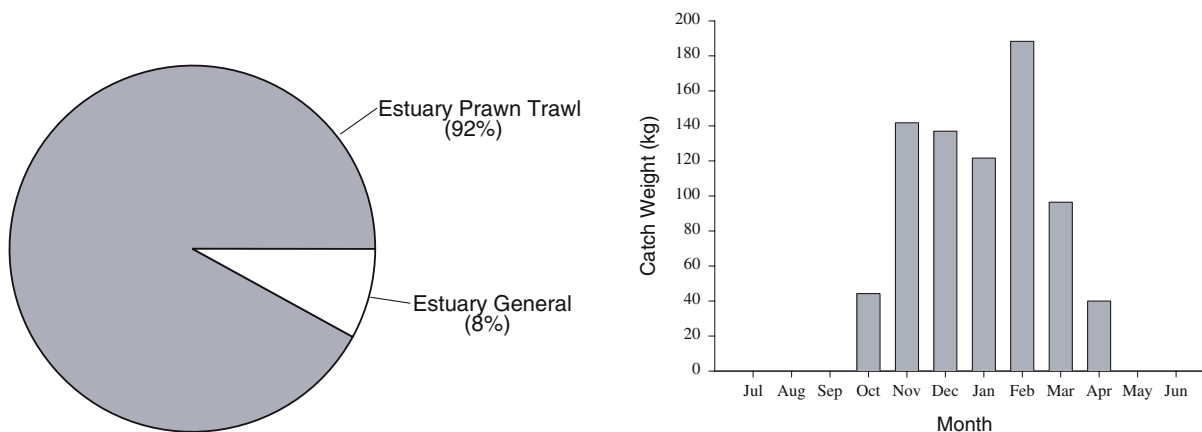


**Botany Bay**

**Figure AB78.** Total annual reported landings (ocean and estuary) of octopus for Botany Bay.

(Note: Estimates of value in this graph are calculated from the average monthly prices at the Sydney Fish Market and may underestimate the value of the fishery).

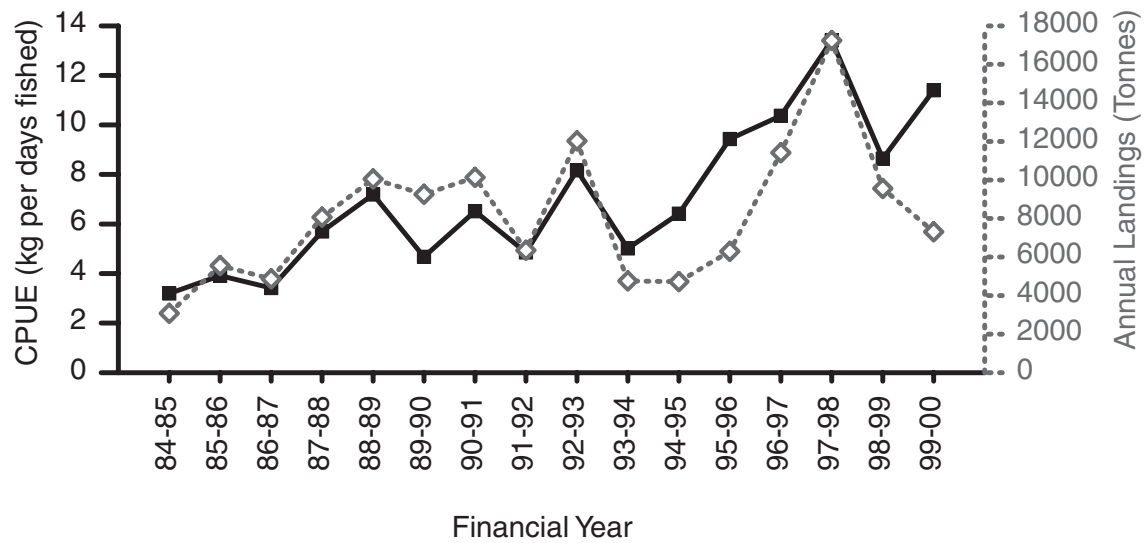
Total annual reported landings by weight and value for octopus from Botany Bay rose until 1990-91 and have fluctuated since then (Figure AB78).



**Figure AB79.** The (a) mean proportion contributed by each fishery to the total annual reported landings of octopus in Botany Bay and (b) mean monthly reported landings of octopus for 1997-98 and 1998-99 by the Estuary Prawn Trawl Fishery in Botany Bay.

Over the period 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery contributed a mean of 92% by weight to the total annual reported landings of octopus from Botany Bay (Figure AB79(a)). Mean total annual reported landings of octopus over the same period in the Estuary Prawn Trawl Fishery in Botany Bay were highest between November and February (inclusive) (Figure AB79(b)). Total annual reported landings for the Estuary Prawn Trawl Fishery in Botany Bay rose in most years from 1984-85 to 1992-93, then fell to a low in 1993-94 and 1994-95, rose again until 1997-98 and

have fallen in the last two years (Figure AB80). Catch rates have risen in most years since 1984-85 (Figure AB80).



**Figure AB80.** Total annual reported landings (grey diamond and line) and catch rates (black square and line) of octopus in the Estuary Prawn Trawl Fishery in Botany Bay.

## APPENDIX B6. TIME AND AREA CLOSURES IN THE ESTUARY PRAWN TRAWL FISHERY

**Table AB15.** Times when prawn trawling is permitted in NSW estuaries

(The following table is a summary of the current closures to prawn trawling and is to be used as a guide only. The local fisheries officer should be consulted for the most recent closure notices as these are frequently modified).

| Estuary         | Periods when trawling is permitted                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       |
|-----------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Clarence        | From 8am to 6pm on Monday, and 7am to 6pm on each of the days Tuesday to Friday (inclusive) and from 7am to 9am on Saturday, each week during the period from Monday nearest 1 December in each of the years 1999 to 2004 inclusive, to Friday nearest the 31 May in each succeeding year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| Lake Wooloweyah | From 8am to 6pm on Monday, and 7am to 6pm on each of the days Tuesday to Friday (inclusive) and from 7am to 9am on Saturday, in each week during the period from the first Tuesday on/or after 1 October in each of the years 1999 to 2004 inclusive, to the Friday nearest 31 May in each succeeding year                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
| Hunter          | <p>Subject to rules about prawn size (see Table AB17)</p> <p>From 6 am to 6 pm Monday and Wednesday only, but excluding the period from 6 am to 6 pm each public holiday, during the period 3 October 2001 to 30 November 2001 (inclusive). (Note: If a public holiday should fall on a Monday or Wednesday the following day may be worked instead, from 6 a.m. to 6 p.m.)</p> <p>From 6 am to 6 pm Weekdays only, but excluding the period from 6 am to 6 pm each public holiday, during the period 1 December 2001 to 17 April 2002 (inclusive)</p> <p>From 6a.m. to 6p.m. Mondays and Wednesdays each week, during the period 18 April 2002 to 31 May 2002 (inclusive), excluding each public holiday. (Note: If a public holiday should fall on a Monday or Wednesday the following day may be worked instead, from 6a.m. to 6p.m.)</p> <p>Periodic closures may occur during this time when juvenile prawns are abundant. This arrangement is further explained in the section, 'controls on fishing activity'</p> |
| Hawkesbury      | Open all year to prawn trawling, but weekend closures apply to waters upstream of a line drawn from Juno Point to Eleanor Bluff. The start and finishing times of the weekend closures vary for different areas upstream of this line. The waters of Marra Marra Creek and Coba Bay are closed to trawling at night (Table AB22)                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
| Port Jackson    | <p>Subject to rules about prawn size (see Table AB21b)</p> <p>From 5 pm Mondays to Thursdays (inclusive) to 9 am the following day, and from 5 pm Friday to 8 am Saturday in each week, commencing sunset, Monday 29 October 2001 to official sunrise, 29 March 2002 (Good Friday)</p> <p>From 5 pm Mondays to Thursdays (inclusive) to 9 am the following day, and from 5 pm Friday to 8 am Saturday in each week, the commencing and terminating dates as determined by the District Fisheries Officer, Sydney North, as detailed in the closure notification which establishes the operating times in this estuary</p>                                                                                                                                                                                                                                                                                                                                                                                                |
| Botany Bay      | <p>Subject to rules about prawn size (see Table AB 21a)</p> <p>From official sunset on any day to official sunrise on the following day, except from sunset Saturday to sunrise Monday in each week, commencing official sunset Friday 30th October 2001, to official sunrise, 29 March 2002 (Good Friday)</p> <p>From official sunset on any day to official sunrise on the following day, except from sunset Saturday to sunrise Monday in each week, the commencing and terminating dates as determined by the District Fisheries Officer, Sydney South, as detailed in the closure notification which establishes the operating times in this estuary.</p>                                                                                                                                                                                                                                                                                                                                                           |

**Table AB16.**

**FISHERIES MANAGEMENT ACT 1994**  
**Section 11 and Section 8 Notification - Fishing Closure**  
**Clarence River, its lakes, lagoons, inlets, channels, creeks and tributaries**  
*County of Clarence*

I, Edward Obeid, revoke the notification published in government gazette number 122 of 22-10-99 and all amendments thereto, which prohibits fishing in certain waters of Clarence River, its lakes, lagoons, inlets, channels, creeks and tributaries.

I do now, by this notification, prohibit the taking of fish by the methods of fishing specified in Column 1 of Schedules 1 to 16 of this notification, from the waters shown opposite in Column 2, respectively, of those schedules, with the exception of schedules 7, 8B, 8C and 8D. This prohibition will be effective for a period of five (5) years from the date of publication of this notification. Fishing will be further subject to the 'conditions' or 'time periods' as specified in, for, and with respect to, any schedule of this notification.

Note: The word 'Regulation', where appearing in this notification, refers to the *Fisheries Management (General) Regulation 1995*.

**The Hon Edward Obeid OAM, MLC**  
**Minister for Mineral Resources**  
**Minister for Fisheries**

(Note: Only relevant schedules included)

**Schedule 5**

Yamba Bay and McKittrick's Channel -Trawl Nets

| <i>Column 1</i><br><b>Methods</b>                                                | <i>Column 2</i><br><b>Waters</b>                                                                                                                                                                                                                                               |
|----------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| By means of <b>trawl nets</b> of every description, as prescribed by Regulation. | The whole of the waters of that part of the Clarence River being the whole of Yamba Bay and that part of McKittrick's Channel between the old viaduct to Freeburn Island and a line drawn from the eastern extremity of the Middle Training Wall to the Public Wharf at Yamba. |

**Schedule 6**

Clarence River - Weekend Netting

| <i>Column 1</i><br><b>Methods</b>                                                                                                                                                                                                                                                                                                                                   | <i>Column 2</i><br><b>Waters</b>                                                                                                                                                                       |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| By means of nets of every description, except the dip or scoop net, the push or scissors net, hoop or lift net and hand hauled prawn nets, when used for the capture of prawns only, and the landing net, as prescribed by Regulation, with the exception that fish may be taken by the method of fishing described in Column 1 of Schedule 7 of this Notification. | The whole of the waters of the Clarence River together with all its lakes, lagoons, inlets, channels, creeks and tributaries, upstream to its source from its confluence with the South Pacific Ocean. |
| <b>Time period:</b> This closure will only apply from 8 a.m. Saturday to 8 a.m. Monday in each week.                                                                                                                                                                                                                                                                |                                                                                                                                                                                                        |

**Schedule 7**

## Clarence River - Weekend Hauling

| <i>Column 1</i><br><b>Methods</b>                                                                               | <i>Column 2</i><br><b>Waters</b>                                                                                                                                                                                                                                                                                                                                                                              |
|-----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| By means of general purpose hauling nets, as prescribed by Regulation.                                          | The whole of the waters of the Clarence River together with all its lakes, lagoons, inlets, channels, creeks and tributaries from its confluence with the South Pacific Ocean upwards to its source to a line from the western point of entrance to Palmer's Channel north-westerly to the northern point of Mororo Bridge in North Arm, but excluding the waters of Palmer's Channel and Wooloweyah Estuary. |
| <b>Time period:</b> This closure will only apply from 1 April to 31 August each year.                           |                                                                                                                                                                                                                                                                                                                                                                                                               |
| <b>Condition:</b> This schedule permits hauling on weekends as an exception to schedule 6 of this notification. |                                                                                                                                                                                                                                                                                                                                                                                                               |

**Schedule 10**

## Clarence River -Estuarine Trawling Closure

| <i>Column 1</i><br><b>Methods</b>                                                                                                                                                                                                                                                                                     | <i>Column 2</i><br><b>Waters</b>                                                                                                                                                                                                                                                                                                                                                        |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| By means of trawl nets of every description with the exception of the otter trawl net (prawns), fitted with a by-catch reduction device approved by the Director of Fisheries, as prescribed by Regulation, operated from a licensed fishing boat such licence having an endorsement authorising the boat to operate. | The whole of the waters of the Clarence River together with all its lakes, lagoons, inlets, channels, creeks and tributaries, excluding the waters of the Wooloweyah Estuary together with its creeks and tributaries, from its junction with the South Pacific Ocean upwards to the Vehicular ferry crossing at Ulmarra, which are not closed to netting under any other Notification. |
| <b>Time period:</b> from 8 a.m. to 6 p.m. on Monday, and 7 a.m. to 6 p.m. on each of the days Tuesday to Friday (inclusive) and from 7 a.m. to 9 a.m. on Saturday, each week during the period from Monday nearest 1 December in each year (inclusive), to Friday nearest 31 May in each succeeding year.             |                                                                                                                                                                                                                                                                                                                                                                                         |

**Schedule 11**

## Wooloweyah Estuary -Estuarine Trawling Closure

| <i>Column 1</i><br><b>Methods</b>                                                                                                                                                                                                                                                                                                   | <i>Column 2</i><br><b>Waters</b>                   |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------|
| By means of trawl nets of every description with the exception of the otter trawl net (prawns), fitted with a by-catch reduction device approved by the Director of Fisheries, as prescribed by Regulation operated from a licensed fishing boat such licence having an endorsement authorising the boat to operate.                | The whole of the waters of the Wooloweyah Estuary. |
| <b>Time period:</b> from 8 a.m. to 6 p.m. on Monday, and from 7 a.m. to 6 p.m. on each of the days Tuesday to Friday (inclusive) and from 7 a.m. to 9 a.m. on Saturday, in each week during the period from the first Tuesday on/or after 1 October in each year (inclusive), to the Friday nearest 31 May in each succeeding year. |                                                    |

**Schedule 12**

## Oyster Channel -Estuarine Trawling Closure

| <i>Column 1</i><br><b>Methods</b>                                                                                                                     | <i>Column 2</i><br><b>Waters</b>                                                                                                                                                                                                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The use of trawl nets of every description, or by the method of trawling by means of nets of every description for the use of taking fish and prawns. | The whole of the waters of the Oyster Channel from Yamba Road bridge upstream to its junction with the Wooloweyah Estuary determined by a line drawn from the eastern extremity of Joss Island to the eastern extremity of Corokos Island. |

**Schedule 13****The Broadwater (Clarence River) -Estuarine Trawling Closure**

| <i>Column 1</i><br><b>Methods</b>                                                                                                                     | <i>Column 2</i><br><b>Waters</b>                                                                                                                                                                                                 |
|-------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The use of trawl nets of every description, or by the method of trawling by means of nets of every description for the use of taking fish and prawns. | The whole of the waters of the Broadwater area within the Clarence River, northwards from a line between a post marked FD1 on the foreshore of Emerald's Point generally westerly to a post marked FD2 located on Neddy's Point. |

**Schedule 14****The Crystal Bay (Clarence River) - Net Closure**

| <i>Column 1</i><br><b>Methods</b>      | <i>Column 2</i><br><b>Waters</b>                                                                                                                                               |
|----------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| By means of nets of every description. | That piece of water known as Crystal Bay, south and east of a line drawn from the centre of the turning circle of Westringa Place to the northern most point of Witonga Drive. |

**Schedule 15****The Sportsman's Creek (Clarence River) - Net Closure**

| <i>Column 1</i><br><b>Methods</b>      | <i>Column 2</i><br><b>Waters</b>                                                                                                                               |
|----------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------|
| By means of nets of every description. | The whole of the waters of that part of Sportsman's Creek together with its creeks, tributaries and inlets from the weir above Lawrence upwards to its source. |

**Table AB17.**

**FISHERIES MANAGEMENT ACT 1994**  
**Section 11 and Section 8 Notification – Fishing Closure**  
**Hunter River Prawn Trawl Closure 2001 / 2002**

I, Edward Obeid, revoke the notification, and all amendments thereto, which prohibits the taking of fish and prawns by means of trawl nets of every description, and by the method of trawling by means of nets of every description, from all waters of the Hunter River together with all its creeks, tributaries and inlets, from its confluence with the South Pacific Ocean, upstream to its junction with the Williams River, as published in the New South Wales Government Gazette Number 146 of 28 September 2001.

I do now, by this notification, prohibit the taking of fish and prawns by means of trawl nets of every description, and by the method of trawling by means of nets of every description, from all waters of the Hunter River together with all its creeks, tributaries and inlets, from its confluence with the South Pacific Ocean, upstream to its junction with the Williams River.

This prohibition does not extend to the taking of fish (including prawns) by a licensed commercial fisher exercising the authority of an endorsement to operate in the Estuary Prawn Trawl Restricted Fishery, operating from a licensed fishing boat which has a S4 (Hunter River) Prawn Trawl endorsement, and using an otter trawl net (prawns) fitted with a by-catch reduction device approved by the Director of Fisheries, subject to the provisions of this notification.

**The Hon Edward Obeid OAM, MLC**  
**Minister for Mineral Resources**  
**Minister for Fisheries**

Prawn trawling period:

1. From 6a.m. to 6p.m. Mondays and Wednesdays each week, during the period 3 October 2001 to 30 November 2001 (inclusive), excluding each public holiday. (Note: If a public holiday should fall on a Monday or Wednesday the following day may be worked instead, from 6a.m. to 6p.m.)

2. From 6a.m. to 6p.m. weekdays only, during the period 1 December 2001 to 17 April 2002 (inclusive), excluding 24 December 2001 and each public holiday

3. From 6a.m. to 6p.m. on Sunday 23 December 2001

4. From 6a.m. to 6p.m. Mondays and Wednesdays each week, during the period 18 April 2002 to 31 May 2002 (inclusive), excluding each public holiday. (Note: If a public holiday should fall on a Monday or Wednesday the following day may be worked instead, from 6a.m. to 6p.m.).

#### CONDITIONS AND SUBDIVISIONS

For the purposes of periodic closing and opening of the Hunter River to prawn trawling during the period 3 October 2001 to 31 May 2002, the following conditions and subdivisions will apply:

##### **Conditions**

A prawn trawling trial may be undertaken to establish the size of prawns available or the abundance of prohibited size class of fish by-catch. The trial is to be undertaken in a manner agreed between the District Fisheries Officer, Hunter, and the elected Management Advisory Committee (MAC) representative for the Hunter River.

The size of prawns is to be indirectly established by a random count of prawns from a vessel's unsorted catch, which shall be weighed and counted to establish the number of prawns per 500 grams. This process is hereafter referred to as 'the count'. For the purposes of this notification the count must be equal to or less than 150 prawns before a subdivision may be opened to prawn trawling.

A Fisheries Officer may close a subdivision where the count at any time is more than 150 prawns per 500g or where the number of any prohibited size class of fish by-catch exceeds 50 fish per shot. Once a count of prawns and/or prohibited size class of fish by-catch has been completed, a further trial may not be undertaken for at least 7 days.

Where a subdivision is closed, subdivisions upstream of that closure are also closed unless a trial is undertaken that meets the relevant criteria. Such further trials are only to be undertaken at the request of the elected MAC representative.

The opening of any subdivision shall be notified by a notice displayed in the Newcastle Fishermen's Co-operative, the NSW Fisheries Office at Newcastle and other prominent locations as agreed between the District Fisheries Officer and representatives of persons entitled to prawn trawl in the Hunter River. The closing of a subdivision shall be notified by a public notice in the Newcastle Herald newspaper and notices displayed in the Newcastle Fishermen's Co-operative and the NSW Fisheries Office at Newcastle.

A notice must provide the following information:

- Date of trial and location of trial
- Prawn count details
- Prohibited size class of fish by-catch
- Area of closure

- Period of closure
- Proposed date and location of next trial.

A sub-divisional closure is to take effect immediately after the count has occurred, if there are more than 150 prawns per 500 grams or where the number of any prohibited size class of fish by-catch exceeds 50 fish per shot.

### **Subdivisions**

For the purposes of this notification, the following subdivisions of the Hunter River may be closed and opened subject to the conditions of this notice.

#### *Subdivision 1*

The waters of the Hunter River downstream of it's junction with the Williams River to it's junction with Scotch Creek inclusive.

#### *Subdivision 2*

The waters of the Hunter River downstream of the junction of Scotch Creek to the Hexham road-bridge, inclusive.

#### *Subdivision 3*

The waters of the Hunter River (North Channel) downstream of the Hexham road-bridge to the junction with Mosquito Creek inclusive.

#### *Subdivision 4*

The waters of the Hunter River north channel and Mosquito Creek downstream to the Stockton road-bridge, inclusive, but excluding Fern Bay.

#### *Subdivision 5*

The waters of Fern Bay (Fullerton Cove) from a line at the southern end of Smiths Island and Sandy Island located at the deep northern channel of the Hunter River, inclusive.

#### *Subdivision 6*

The waters of the Hunter River (North Channel) downstream of the Stockton road-bridge to a line drawn south-westerly from the point of intersection of the south-westerly prolongation of the northwest side of Punt road, Stockton, with the high water mark to the most south-eastern point of the State dockyard Wharf. Also, the South Channel to the Tourle Street Bridge inclusive.

#### *Subdivision 7*

The waters of the Hunter River (South Channel) upstream of the Tourle Street Bridge, to the junction of the Hunter River (South Channel) and the Hunter River (North Channel) inclusive, at Hexham.



Table AB18.

FC3255, F92/2022C

**FISHERIES MANAGEMENT ACT 1994**  
**Section 11 and 8 - Fishing Closure**  
**Hunter River Prawning Closure (Amateur Prawn Nets)**  
**2001 / 2002 season**

I, Edward Obeid, revoke the notification, and all amendments thereto, which prohibits the use of recreational prawning nets, from the whole of the waters of the Hunter River from the South Pacific Ocean upstream to the junction with the Williams River as published in the New South Wales Government Gazette Number 127 of 29 October 2000.

I do now, by this notification, prohibit the taking of fish and prawns by the use of the hand hauled prawn net, and the push or scissors net (prawns), from the whole of the waters of that part of the Hunter River together with its creeks, tributaries and inlets from the South Pacific Ocean upstream to the junction of the Williams and Hunter Rivers.

This prohibition does not extend to the taking of fish and prawns by the methods of fishing described in Column 1 of the schedule to this Notification, from the waters described in Column 2 of the schedule, for the period specified in Column 3 of the schedule.

**The Hon Edward Obeid OAM, MLC**  
**Minister for Mineral Resources**  
**Minister for Fisheries**

**Schedule**

| <b>Methods</b>                                                                                                                                                                                            | <b>Waters</b>                                                                                                                                                                                        | <b>Period</b>                          |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------|
| By means of a hand hauled prawn net, as prescribed by clause 48 of the Fisheries Management (General) Regulation 1995, and the push or scissors net (prawns) as prescribed by clause 49 of the Regulation | County of Northumberland; The waters of the Hunter River, together with its creeks and tributaries, from its confluence with the South Pacific Ocean upwards to its junction with the Williams River | From 30 September 2001 to 27 May 2002. |

**Table AB19.**

**Hawkesbury River Prawn Trawling  
SCHEDULE 2, Fisheries Management (General) Regulation 1995  
Waters in which net and trap fishing are prohibited  
(Clause 18)**

**Brisbane Water/Broken Bay  
Brisbane Water or any of its tributaries; Broken Bay north of a line drawn  
from Little Box Head to Green Point.  
FISHERIES MANAGEMENT ACT 1994  
Section 11 and Section 8 Notification - Fishing Closure  
General Estuarine Prawn Trawling Closure  
Hawkesbury River**

I, Edward Obeid, revoke the notification, and all amendments thereto, which prohibits the taking of fish and prawns by means of trawl nets of every description, and by the method of trawling by means of nets of every description, from all waters of the Hawkesbury River together with all its creeks, tributaries and inlets, from its confluence with the South Pacific Ocean, upstream to the vehicular ferry crossing at Lower Portland, as published in the New South Wales Government Gazette Number 109 of 10 October 1997.

I do now, by this notification, prohibit the taking of fish and prawns by means of trawl nets of every description, and by the method of trawling by means of nets of every description, from all waters of the Hawkesbury River together with all its creeks, tributaries and inlets, from its confluence with the South Pacific Ocean, upstream to the vehicular ferry crossing at Lower Portland.

Prawn trawling conditions:

This prohibition does not extend to the taking of fish (including prawns) by a licensed commercial fisher exercising the authority of an endorsement to operate in the Estuary Prawn Trawl Restricted Fishery, operating from a licensed fishing boat which has a S3 (Hawkesbury River) Prawn Trawl endorsement, and using an otter trawl net (prawns) in the waters described in schedule 1, subject to the provisions of this notification

This prohibition does not extend to the taking of fish (including prawns) by a licensed commercial fisher exercising the authority of an endorsement to operate in the Estuary Prawn Trawl Restricted Fishery, operating from a licensed fishing boat which has a S3 (Hawkesbury River) Prawn Trawl endorsement, and using an otter trawl net (prawns), fitted with a bycatch reduction device approved by the Director of Fisheries in the waters described in schedules 2 to 6, subject to the provisions of this notification

**The Hon Edward Obeid OAM, MLC  
Minister for Mineral Resources  
Minister for Fisheries**

Table AB20.

**Schedule 1**

| <b>Waters in which prawn trawling is permitted</b>                                                                                                                                                                                                                                                                                                                                                                                  | <b>Periods during which prawn trawling is permitted</b>                           |
|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------|
| The waters of the Hawkesbury River, upstream from its entrance to the South Pacific Ocean, to a line drawn across the river from the south-eastern most corner of Juno Point to the north-eastern most corner of Eleanor Bluff and from that point to the north-western most corner indicated by the Port Hand marker on Challenger Head, but excluding Pittwater, south of a line drawn from Shark (or Warners) Rock to West Head. | For a period of five (5) years from the date of publication of this Notification. |

**Schedule 2**

| <i>Column 1</i><br><b>Waters in which prawn trawling is permitted</b>                                                                                                                                                                                                                                            | <i>Column 2</i><br><b>Periods during which prawn trawling is permitted</b>                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| The waters of the Hawkesbury River and its tributaries, upstream from a line drawn across the river from the south-eastern most corner of Juno point to the north-eastern most corner of Eleanor Bluff, to a line drawn from the most westerly point of Croppy Point to the most northerly point of Green Point. | From 6 p.m Sunday to 6 p.m Friday in each week, for a period of five (5) years from the date of publication of this Notification. |

**Schedule 3**

| <i>Column 1</i><br><b>Waters in which prawn trawling is permitted</b>                                                                                                                                                                                                                                                                                                                                      | <i>Column 2</i><br><b>Periods during which prawn trawling is permitted</b>                                                        |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| The waters of the Hawkesbury River and its tributaries, upstream from the rail bridge at Brooklyn to the downstream vehicular ferry crossing at Wiseman's Ferry but excluding Berowra Creek, Marra Marra (or Mother Marr's) Creek and Coba Bay, together with their tributary creeks and bays upstream from the most southwesterly point of Morgan Point to the most southeasterly point of Murrion Point. | From 6 p.m Sunday to 6 p.m Friday in each week, for a period of five (5) years from the date of publication of this Notification. |

**Schedule 4**

| <i>Column 1</i><br><b>Waters in which prawn trawling is permitted</b>                                                                                                                                                                                   | <i>Column 2</i><br><b>Periods during which prawn trawling is permitted</b>                                                                                                                                  |
|---------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The waters of Marra Marra (or Mother Marr's) Creek and Coba Bay, upstream from a line drawn from the most southeasterly point of Murrion point to the most southwesterly point of Morgan Point and then to the northeastern point of entry to Coba Bay. | From sunrise to sunset in each of the days Monday to Thursday (inclusive), and from sunrise to 6 p.m Friday in each week, for a period of five (5) years from the date of publication of this Notification. |

**Schedule 5**

| <i>Column 1</i><br><b>Waters in which prawn trawling is permitted</b>                             | <i>Column 2</i><br><b>Periods during which prawn trawling is permitted</b>                                                        |
|---------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------|
| Mangrove Creek together with its tributary creeks and bays, upstream to Oyster Shell Road Bridge. | From 6 p.m Sunday to 6 p.m Friday in each week, for a period of five (5) years from the date of publication of this Notification. |

**Schedule 6**

| <i>Column 1</i><br><b>Waters in which prawn trawling is permitted</b>                                                                                                                                                                                                                                                                                | <i>Column 2</i><br><b>Periods during which prawn trawling is permitted</b>                                                     |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------|
| The waters of the Hawkesbury River, upstream of the Wiseman's Ferry vehicular ferry crossing, but excluding MacDonald River, Colo River (upstream of the West Portland Road bridge approximately 250 metres from its junction with the Hawkesbury River), and Webbs Creek, and their tributaries, to the vehicular ferry crossing at Lower Portland. | From 9 p.m Sunday to 6 p.m Friday each week, for a period of five (5) years from the date of publication of this Notification. |

**Table AB21(a)** Closure to commercial fishing-Botany Bay 1st May 2002.

**FISHERIES MANAGEMENT ACT 1994**  
**Section 8 Notification - Fishing Closure**

I, Edward Obeid, prohibit the taking of fish for sale by the methods of commercial fishing described in Column 1 of schedule to this notification, from the waters described in Column 2, during the period specified in Column 3, respectively, of that schedule. This notification will be effective from 1 May 2002 for a period of five (5) years. This notification replaces all other commercial fishing closures currently in force in the waters of Botany Bay prescribed in the schedule below.

**The Hon Edward Obeid OAM, MLC**  
**Minister for Mineral Resources**  
**Minister for Fisheries**

**Schedule**

| <i>Column 1</i><br><b>Methods</b>                                                                                                                   | <i>Column 2</i><br><b>Waters</b>                                                                  | <i>Column 3</i><br><b>Period</b> |
|-----------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|----------------------------------|
| All methods, with the exception that lobsters and abalone may be taken by in accordance with the relevant share management fishery management plans | The whole of the waters of Botany Bay, together with all its tributaries, creeks, bays and inlets | For a period of five years.      |

**Table AB21(b).** Fishing Closure-Botany Bay and Port Jackson Estuary Prawn Trawl Fisheries for the 2001 season.

**FISHERIES MANAGEMENT ACT 1994**  
**Section 8 Notification - Fishing Closure**  
**General Estuarine Prawn Trawling Closures**  
Port Jackson and Botany Bay

I, Edward Obeid, prohibit the taking of fish and prawns by means of trawl nets of every description, or by the method of trawling by means of nets of every description, from all waters of Port Jackson and Botany Bay, for a period of one (1) year from the date of publication of this Notification.

For the purposes of this Notification, the following condition applies:

This prohibition does not extend to the taking of fish and prawns by a licensed commercial fisher holding an endorsement to operate in the Estuary Prawn Trawl Restricted Fishery, operating from a licensed fishing boat which holds the appropriate Estuarine Prawn Trawl Endorsement, issued by NSW Fisheries, when fishing in the waters described in Column 1 of Schedules 1 and 2 of this Notification, during the period shown opposite in Column 2 of those Schedules, if using an otter trawl net (prawns), with a Bycatch Reducing Device as described in the Note of Schedules 1 and 2 of this Notification.

In the event of an inconsistency between this closure notification and the closure notification relating to the termination of certain commercial fishing practices in Botany Bay published in Government Gazette No. 132 of 31 August 2001, the closure notification published in Government Gazette No. 132 of 31 August 2001 will apply.

**The Hon Edward Obeid OAM, MLC**

**Minister for Mineral Resources  
Minister for Fisheries**

**Schedule 1**

*Port Jackson Prawn Trawling*

| <i>Column 1</i><br><b>Waters</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                       | <i>Column 2</i><br><b>Periods during which prawn trawling is permitted</b>                                                                                                                                                                                                                                                                                                                                                                                                                                           |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The waters of Port Jackson together with all its rivers, bays and tributaries which are not closed to netting under any other schedule or Notification.                                                                                                                                                                                                                                                                                                                                                                                                                                                                | <p>1. From 5 p.m. Mondays to Thursdays (inclusive) to 9 a.m. the following day, and from 5 p.m. Friday to 8 a.m. Saturday in each week, in the period between 5 p.m. Monday 29 October 2001 and 8 a.m. Friday 29 March 2002 (Good Friday)</p> <p>2. From 5 p.m. Mondays to Thursdays (inclusive) to 9 a.m. the following day, and from 5 p.m. Friday to 8 a.m. Saturday in each week, in a period as determined by the District Fisheries Officer, Sydney North, as detailed in the conditions of this Schedule.</p> |
| <p>Note: Any one of the following Bycatch Reducing Devices must be incorporated into the otter trawl net (prawns) used by any licensed fishing boat holding a S2 Port Jackson Prawn Trawl Endorsement:</p> <ol style="list-style-type: none"> <li>1. Port Jackson screen - as per diagram 1 and specifications contained therein</li> <li>2. Soft mesh BRD (blubber chute) - as per diagram 2 and specifications contained therein</li> <li>3. Nordmore grid - as per diagram 3 and specifications contained therein</li> <li>4. Square mesh panel - as per diagram 4 and specifications contained therein.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |

**Schedule 1 Conditions:**

**Early opening and late closing trial criteria for Port Jackson prawn trawling:**

- 1) A prawn trawling trial may be undertaken to establish the early opening or late closing of the Port Jackson prawn trawling season. The trial is to be undertaken in a manner agreed between the District Fisheries Officer, Sydney North, and representatives of persons entitled to prawn trawl in Port Jackson
- 2) Five 40 minute shots at different locations of which at least one shot yields a minimum of 1 kilogram of product (prawns) will allow Port Jackson to be opened to estuarine prawn trawling, as determined by the District Fisheries Officer, Sydney North
- 3) The opening of the Port Jackson prawn trawling season shall be notified by a notice displayed at the Sydney Fish Markets, the NSW Fisheries office at Wollstonecraft and other prominent locations agreed between the District Fisheries Officer and representatives of persons entitled to prawn trawl in Port Jackson. The closing of the Port Jackson prawn trawling season shall be notified by a public notice in the Sydney Herald newspaper and notices displayed at the Sydney Fish Markets and the NSW Fisheries Office at Wollstonecraft.

**Early opening trials:** The first opening trial shall commence 5 p.m. Friday 12 October 2001. If the trial criteria is reached the Port Jackson prawn trawling season opens 5 p.m. Monday 15 October 2001. If the trial criteria is not reached a second trial should be conducted 5 p.m. Friday 19 October 2001. If this trial criteria is reached the Port Jackson prawn trawling season opens 5 p.m. Monday 22 October 2001. Otherwise the season opens 5 p.m. Monday 29 October 2001. If the early opening criteria for Botany Bay prawn trawling season is reached the Port Jackson prawn trawling season shall open 5p.m. that same day.

**Extended closing trials:** The first closing trial shall commence 5 p.m. Wednesday 10 April 2002. If the trial criteria is reached the Port Jackson prawn trawling season shall be extended to 9 a.m. Friday 26 April 2002. A second closing trial shall commence 5 p.m. Wednesday 24 April 2002. If this trial criteria is reached the Port Jackson prawn trawling season shall be extended to 9 a.m. Friday 10 May 2002. If the extended opening criteria for Botany Bay prawn trawling season is reached the Port Jackson prawn trawling season shall be extended to 9 a.m. that same day.

**Schedule 2***Botany Bay Prawn Trawling*

| <i>Column 1</i><br><b>Waters</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                             | <i>Column 2</i><br><b>Periods during which prawn trawling is permitted</b>                                                                                                                                                                                                                                                                                                                                                                                                                                                                         |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| The whole of the waters of Botany Bay, together with all its tributaries, creeks, bays and inlets, seawards (east) of a line drawn from Doll's Point to Towra Point, which are not closed to netting under any other Notification, and excluding the waters of Cooks River                                                                                                                                                                                                                                                   | <p>1. From official sunset on any day to official sunrise on the following day, except from sunset Saturday to sunrise Monday in each week, in the period between the official sunset Monday 29 October 2001, and the official sunrise, 29 March 2002 (Good Friday).</p> <p>2. From official sunset on any day to official sunrise on the following day, except from sunset Saturday to sunrise Monday in each week, in the period determined by the District Fisheries Officer, Sydney South, as detailed in the conditions of this Schedule.</p> |
| <p>Note: Any one of the following Bycatch Reducing Devices must be incorporated into the otter trawl net (prawns) used by any licensed fishing boat holding a S1 Botany Bay Prawn Trawl Endorsement:</p> <ol style="list-style-type: none"> <li>1. Soft mesh BRD (blubber chute) - as per diagram 2 and specifications contained therein</li> <li>2. Nordmore grid - as per diagram 3 and specifications contained therein</li> <li>3. Square mesh panel - as per diagram 4 and specifications contained therein.</li> </ol> |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |

**Schedule 2 Conditions:****Early opening and late closing trial criteria for Botany Bay prawn trawling:**

1) A prawn trawling trial may be undertaken to establish the early opening or late closing of the Botany Bay prawn trawling season. The trial is to be undertaken in a manner agreed between the District Fisheries Officer, Sydney South, and representatives of persons entitled to prawn trawl in Botany Bay.

2) Five 40 minute shots at different locations of which at least one shot yields a minimum of 1 kilogram of product (prawns) will allow Botany Bay to be opened to estuarine prawn trawling, as determined by the District Fisheries Officer, Sydney South.

3) The opening of the Botany Bay prawn trawling season shall be notified by a notice displayed at the Sydney Fish Markets, the NSW Fisheries office at San Souci and other prominent locations agreed between the District Fisheries Officer and representatives of persons entitled to prawn trawl in Botany Bay. The closing of the Botany Bay prawn trawling season shall be notified by a public notice in the Sydney Herald newspaper and notices displayed at the Sydney Fish Markets and the NSW Fisheries Office at San Souci.

**Early opening trials:** The first opening trial shall commence at the official sunset on 12 October 2001. If the trial criteria is reached the Botany Bay prawn trawling season opens at the official sunset on Monday 15 October 2001. If the trial criteria is not reached a second trial should be conducted at the official sunset on Friday 19 October 2001. If this trial criteria is reached the Botany Bay prawn trawling season opens at the official sunset on Monday 22 October 2001. Otherwise the season opens at the official sunset on Monday 29 October 2001. If the early opening criteria for the Port Jackson prawn trawling season is reached the Botany Bay prawn trawling season shall open at the official sunset that same day.

**Extended closing trials:** The first closing trial shall commence at the official sunset on Wednesday 10 April 2002. If the trial criteria is reached the Botany Bay prawn trawling season shall be extended to the official sunrise on Friday 26 April 2002. A second closing trial shall commence at the official sunset on Wednesday 24 April 2002. If the trial criteria is reached the Botany Bay prawn trawling season shall be extended to the official sunrise on Friday 10 May 2002. If the Port Jackson prawn trawling season is extended until Friday 26 April, the Botany Bay Prawn Trawling season shall be extended to the official sunrise on that same Friday. If the extended opening criteria for Port Jackson prawn trawling season is reached the Botany Bay prawn trawling season shall be extended to 9 a.m. that same day.

**FISHERIES MANAGEMENT (AQUATIC RESERVES) REGULATION 1995**

**under the  
FISHERIES MANAGEMENT ACT 1994  
UPDATED 1 MARCH 1999  
PART 5—NORTH HARBOUR**

**The Reserve**

16. In this Part:

“Reserve” means the North Harbour Aquatic Reserve declared by notification published in Gazette No. 46 of 26 March 1982, at page 1336, being the land described in Schedule 4 together with the waters within the Reserve.

**Taking of fish or marine vegetation prohibited**

17. (1) A person must not:

- (a) take, or attempt to take, fish from the Reserve or
- (b) gather, or attempt to gather, marine vegetation from the Reserve.

Maximum penalty: 100 penalty units in the case of a corporation, 50 penalty units in any other case.

(2) A person must not:

- (a) wilfully disturb, injure or interfere with fish in the Reserve or
- (b) wilfully damage, destroy or interfere with marine vegetation in the Reserve.

Maximum penalty: 100 penalty units in the case of a corporation, 50 penalty units in any other case.

(3) This clause is subject to the other provisions of this Part.

**General exemption**

18. A person:

- (a) may, by means of a hook and line, take, or attempt to take, fish that have fins and
- (b) may, in accordance with the written consent of the Director, do anything else prohibited by clause 17(1) or (2).

**Exemption for commercial fishers**

19. A commercial fisher:

- (a) may take, or attempt to take, a rock lobster by means of a pot manufactured or adapted for the purpose of taking rock lobsters and
- (b) may, on a weekday, take, or attempt to take, fish by means of a hauling net, but only from the part of the Reserve north of Cannae Point and east of a line drawn from Cannae Point to Manly Point.

**PART 8—TOWRA POINT**

**The Reserve**

26. In this Part:

“refuge zone” means the area shown lightly dotted in the diagram in Schedule 7

“Reserve” means the Towra Point Aquatic Reserve declared by notification published in Gazette No. 49 of 12 April 1990, at page 3070, being the land described in Schedule 7 together with the waters within the Reserve

“sanctuary zone” means the area (generally referred to as Stinkpot Bay, Quibray Bay and Weeney Bay) shown hatched in the diagram in Schedule 7

**Taking of fish or marine vegetation prohibited.**

27. (1) A person must not:

- (a) take, or attempt to take, fish from the Reserve or
- (b) gather, or attempt to gather, marine vegetation from the Reserve.

Maximum penalty: 100 penalty units in the case of a corporation, 50 penalty units in any other case.

(2) A person must not:

- (a) wilfully disturb, injure or interfere with fish in the Reserve or

(b) wilfully damage, destroy or interfere with marine vegetation in the Reserve.

Maximum penalty: 100 penalty units in the case of a corporation, 50 penalty units in any other case.

(3) This clause is subject to the other provisions of this Part.

**General exemption**

28. (1) A person:

(a) may take, or attempt to take, fish from the refuge zone by means of

(i) a hook and line or

(ii) a net that may lawfully be used otherwise than by a commercial fisher and

(b) may, in accordance with the written consent of the Director, do anything else prohibited by clause 27(1) or (2).

(2) The exemption under subclause (1)(a) does not authorise a person to take, or attempt to take, fish from the sanctuary zone.

**Exemption for commercial fishers.**

29. (1) A commercial fisher may take, or attempt to take, fish from the refuge zone by means of:

(a) lawful hauling nets or garfish nets (bullringing) or

(b) lawful meshing nets, but only when used by the method known as splashing (that is, shooting the net, splashing the water in the vicinity and fully retrieving the net from the water without delay) or

(c) lawful fish traps.

(2) The exemption under subclause (1) does not authorise a person to take, or attempt to take, fish from the sanctuary zone.



## APPENDIX B7. LEGAL MINIMUM LENGTHS AND BAG LIMITS

### Saltwater Legal Lengths and Bag Limits

Not all fish species are subject to a legal length.

There are five bag limit categories – zero, two, five, 10 or 20 fish per angler.

**A maximum daily bag limit of 20** will apply to any fish or invertebrate not included in the tables below, except baitfish\*.

\*Pilchards, whitebait, bluebait, herring, anchovies, yellowtail, jack mackerel, slimy mackerel, garfish, hardyheads, soldier crabs, saltwater nippers and worms, except beach worms which are subject to a bag limit of 20.

**Legal length** - is the minimum unless otherwise stated.

**Bag limit** - is the maximum number **per person in possession**.

|                                                                                     | FISH                                                                | Legal length (cm)                    | Bag limit                      |
|-------------------------------------------------------------------------------------|---------------------------------------------------------------------|--------------------------------------|--------------------------------|
|    | Australian bass and estuary perch                                   | Only 1 fish longer than 35cm         | 4 in total (max.2 per day)     |
|   | Australian salmon                                                   | —                                    | 5                              |
|  | Bream (black/southern, yellowfin)                                   | 25                                   | 20 in total                    |
|  | Eels (short & long finned)                                          | 30                                   | 20 in total                    |
|  | Flathead, dusky/common                                              | 36<br>(only 1 fish longer than 70cm) | 10                             |
|  | Flathead (sand, tiger)                                              | 33                                   | 20 in total                    |
|                                                                                     | Flathead, all other                                                 | —                                    |                                |
|                                                                                     | Deep-sea fish (hapuka, bar cod, bass groper, gemfish, blue-eye cod) | —                                    | 5 in total (max. of 2 gemfish) |
|  | Groper (blue, red/brown)                                            | —                                    | 2 in total (by line only)      |
|  | Hairtail                                                            | —                                    | 10                             |
|  | Kingfish, yellowtail                                                | 60                                   | 5                              |

|                                                                                     |                               |                                         |                                        |
|-------------------------------------------------------------------------------------|-------------------------------|-----------------------------------------|----------------------------------------|
|    | Luderick                      | 25                                      | 20                                     |
|                                                                                     | Mackerel (Spanish, spotted)   | –                                       | 5 in total                             |
|                                                                                     | Mangrove Jack                 | –                                       | 5                                      |
|                                                                                     | Marlin (striped, black, blue) | –                                       | 2                                      |
|    | Morwong (jackass, rubberlip)  | 28                                      | 20                                     |
|    | Morwong (red/ sea carp)       | 25                                      | 5                                      |
|                                                                                     | Morwong, banded               | –                                       | 5                                      |
|                                                                                     | Moses perch                   | –                                       | 5                                      |
|                                                                                     | Mullet (sea/bully)            | 30                                      | 20                                     |
|                                                                                     | Mullet, poddy (for live bait) | Less than 15cm                          | 20                                     |
|    | Mulloway (or jewfish)         | 45<br>(only 2 fish longer<br>than 70cm) | 5                                      |
|   | Pearl perch                   | –                                       | 5                                      |
|                                                                                     | Rock blackfish                | 30                                      | 10                                     |
|                                                                                     | Sailfish                      | –                                       | 2                                      |
|  | Sharks and rays               | 91<br>(School shark only)               | 5 in total<br>(max. of 2<br>Wobbegong) |
|  | Snapper                       | 30                                      | 10                                     |
|                                                                                     | Spearfish                     | –                                       | 2                                      |
|  | Surgeon, sawtail              | –                                       | 5                                      |
|                                                                                     | Swordfish                     | –                                       | 2                                      |
|  | Tailor                        | 30                                      | 20                                     |
|  | Tarwhine                      | 20                                      | 20                                     |



Teraglin

38

5

Trevallies

—

20 in total

Tuna (albacore, big-eye, longtail, southern bluefin, yellowfin)

90 or above

2 in total

Tuna (albacore, big-eye, longtail, southern bluefin, yellowfin)

Less than 90

5 in total

Wahoo

—

5



Whiting

27  
(sand only)

20 in total

# **INVERTEBRATE**

## **Legal length (cm)**

## **Bag limit**



Abalone

11.5

10



Beach worms

—

20

Cockles, mussels (pipis for bait only –  
– do not take beyond 50m of high-  
tide mark)

50 in total



Crab, blue swimmer

6

20



Crab (mud, black/mangrove)

8.5

5

Crab, spanner

9.3

10

Crab (all other, except soldier)

—

10 in total



Cunjevoi

–

20



Lobster, eastern rock

Min.10.4 – max.20

2 in total

Lobster, southern rock (male)

11

Lobster, southern rock (female)

10.5

Lobster (painted, ornate)

–

2 in total

Lobster (slipper, flat)

–

2 in total

Oysters (Sydney rock, Pacific, flat)

–

50 in total



Prawns

–

10 litres

Scallops

–

50



Sea urchins

–

10



Turban snails (Sydney, military)

7.5

20

#### **ADDITIONAL REGULATIONS**

- Octopus cannot be taken from ocean rock platforms in NSW or rock platforms in Sydney Harbour.
- All lobsters and crabs carrying eggs must be returned immediately to the water. It is an offence to remove the eggs.
- Intertidal invertebrates must not be shucked in or adjacent to any waters except for immediate use as bait.
- Gathering invertebrates in Intertidal Protected Areas (IPA) is prohibited.
- Commercially produced oysters are purified prior to sale. NSW Health recommends cooking oysters which have not been purified as they may contain harmful bacteria.

#### **PROTECTED SPECIES**

Bag limit of zero (0) - if caught these species must be returned carefully to the water.

Elegant wrasse

Ballina angelfish

Estuary cod

Black rock cod

Giant Queensland groper

Weedy (common) seadragon

Eastern blue devil fish

Herbsts nurse shark

Grey nurse shark

Great white shark

Green sawfish



## APPENDIX B8. PRESENT RESEARCH PLAN

| Research Project                                                                        | 1999/00 | 2000/01 | 2001/02 | 2002/03 | 2003/04 | 2004/05 | Priority | Actual/ Possible funding source | Comments                                                                                                                                                                                                                                                                               |
|-----------------------------------------------------------------------------------------|---------|---------|---------|---------|---------|---------|----------|---------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General Biology</b>                                                                  |         |         |         |         |         |         |          |                                 |                                                                                                                                                                                                                                                                                        |
| Factors affecting recruitment of prawns to estuaries                                    |         |         |         |         |         |         | H        |                                 | Identify the main nursery areas for prawns. Investigate spawner recruit relationship                                                                                                                                                                                                   |
| Studies on the growth and mortality of school prawns                                    |         |         |         |         |         |         | M        | FRDC                            | Funding has been approved by FRDC but the commencement date has been delayed a year.                                                                                                                                                                                                   |
| Investigations into the effects of riddling upon the survival of prawns                 |         |         |         |         |         |         | H        |                                 | Priority # 3 at Small Prawn Summit. Studies were incorporated into the the growth and mortality study that went to FRAC in 2000 but FRAC wanted the riddling component deleted from the proposal. A proposal will be submitted again to FRAC if there is MAC support                   |
| Population dynamics of Hawkesbury River Squid Fishery                                   |         |         |         |         |         |         | U        | SPIRT                           | Assessment of the fishery and development of species specific gear. Studies are under way.                                                                                                                                                                                             |
| <b>Stock Assessment</b>                                                                 |         |         |         |         |         |         |          |                                 |                                                                                                                                                                                                                                                                                        |
| Annual analysis of catch and effort statistics                                          |         |         |         |         |         |         | U        |                                 | Analysis of data on LCATCH dadatabase. This is On-going                                                                                                                                                                                                                                |
| Log-book for the EPT                                                                    |         |         |         |         |         |         | L        |                                 | Consider implementing a log-book into the Estuary Prawn Trawl Fishery.                                                                                                                                                                                                                 |
| Observer-based surveys to collect information about catches of the EPT                  |         |         |         |         |         |         | H        |                                 | A scientifically based observer program. Priority # 1 at the Small Prawn Summit. Develop an optimal sampling strategy for collecting species and size information data on species in the catch of the Ocean Prawn Trawl Fishery. This will be an observer study that will be on-going. |
| Map the trawl grounds of the Estuary Prawn Trawl Fishery.                               |         |         |         |         |         |         | L        |                                 | Applications so far have been unsuccessful. Industry is being asked to cooperate.                                                                                                                                                                                                      |
| Map environmentally sensitive areas within estuaries of the Estuary Prawn Trawl Fishery |         |         |         |         |         |         | H        |                                 |                                                                                                                                                                                                                                                                                        |
| Assessments of target species other than penaeids                                       |         |         |         |         |         |         | H        |                                 | Samples to be collected as part of observer surveys. Possible application for external funding help fund post-graduate studies.                                                                                                                                                        |

## Estuary Prawn Trawl Research Plan (cont).

|                                                                                                  |  |  |  |  |  |  |  |      |                                                                                                                                              |
|--------------------------------------------------------------------------------------------------|--|--|--|--|--|--|--|------|----------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Habitat and Ecosystem</b>                                                                     |  |  |  |  |  |  |  |      |                                                                                                                                              |
| Investigate the effects of square mesh codends upon the species and size composition of catches. |  |  |  |  |  |  |  | FRDC | Priority # 1 at Juvenile Prawn Summit. FRDC project commences 2001-02                                                                        |
| Investigate the effects of fishing upon the sea-floor and the benthic and epibenthic communities |  |  |  |  |  |  |  | U    |                                                                                                                                              |
| Alternative gears or configurations for trawl gear to target specific species                    |  |  |  |  |  |  |  | L    | Reduce impact of trawl gear on the sea-floor and epibenthic communities. Identified at the Juvenile Prawn summit as an area needing reserach |
| Biology of non-target species                                                                    |  |  |  |  |  |  |  | M    | Information about species discarded from the by-catch to be collected as part of observer studies.                                           |
| <b>Management and Modelling</b>                                                                  |  |  |  |  |  |  |  |      |                                                                                                                                              |
| Determine biologically optimal harvest conditions for eastern king prawns                        |  |  |  |  |  |  |  | U    | Data already exist for this to be at least initially, a "desk top" study.                                                                    |
| Ascertain the most appropriate trigger points for managing the EPT fishery                       |  |  |  |  |  |  |  | L    | Desk-top study                                                                                                                               |
| Socio-economic study of the EPT                                                                  |  |  |  |  |  |  |  | L    | Information would be helpful as baseline data to assess the impact of the Fisheries Management Strategy.                                     |
| <b>Production Technology</b>                                                                     |  |  |  |  |  |  |  |      |                                                                                                                                              |
|                                                                                                  |  |  |  |  |  |  |  |      |                                                                                                                                              |
| <b>Post Harvest</b>                                                                              |  |  |  |  |  |  |  |      |                                                                                                                                              |
|                                                                                                  |  |  |  |  |  |  |  |      |                                                                                                                                              |
| <b>Industry Development</b>                                                                      |  |  |  |  |  |  |  |      |                                                                                                                                              |
|                                                                                                  |  |  |  |  |  |  |  |      |                                                                                                                                              |
| <b>Resource Access</b>                                                                           |  |  |  |  |  |  |  |      |                                                                                                                                              |
|                                                                                                  |  |  |  |  |  |  |  |      |                                                                                                                                              |

*In Progress*  
*Application*  
*Planned*  
*Identified*



H = *High Priority*  
 M = *Medium Priority*  
 L = *Low Priority*  
 U = *Underway*



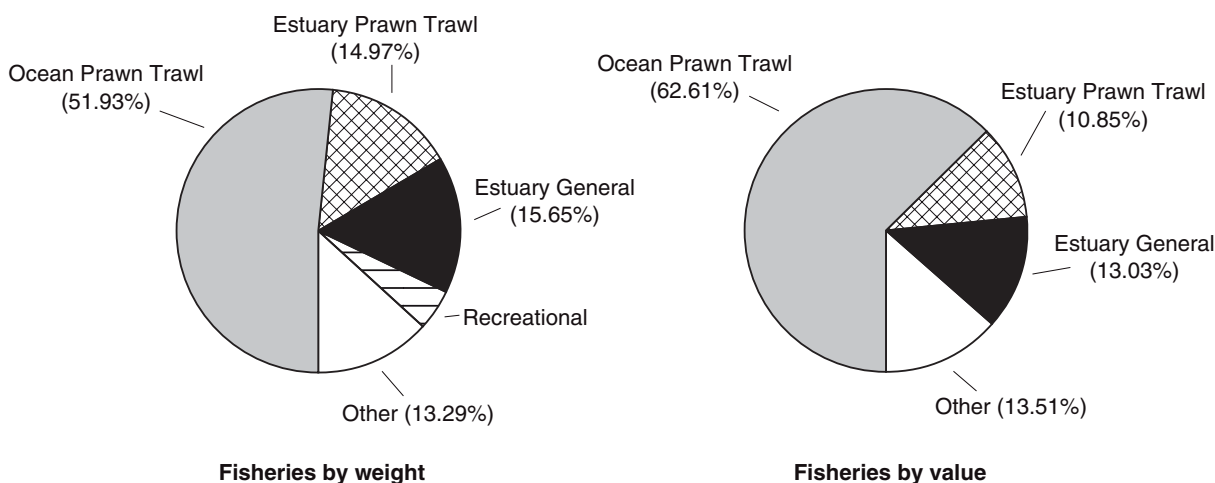
## **APPENDIX E**

## APPENDIX E1. SPECIES STOCK ASSESSMENTS

Of the species listed in Table E1, stock assessment information on yellowtail, school prawns and eastern king prawns can be found in the ‘NSW Fisheries – Status of Fisheries Resources 1999/2000’ (NSW Fisheries, 2001a). Further stock assessment information on the target species of the Estuary Prawn Trawl Fishery and catch trends of the ‘unknown’ species listed in Table E1 follows.

### 1. School and eastern king prawns

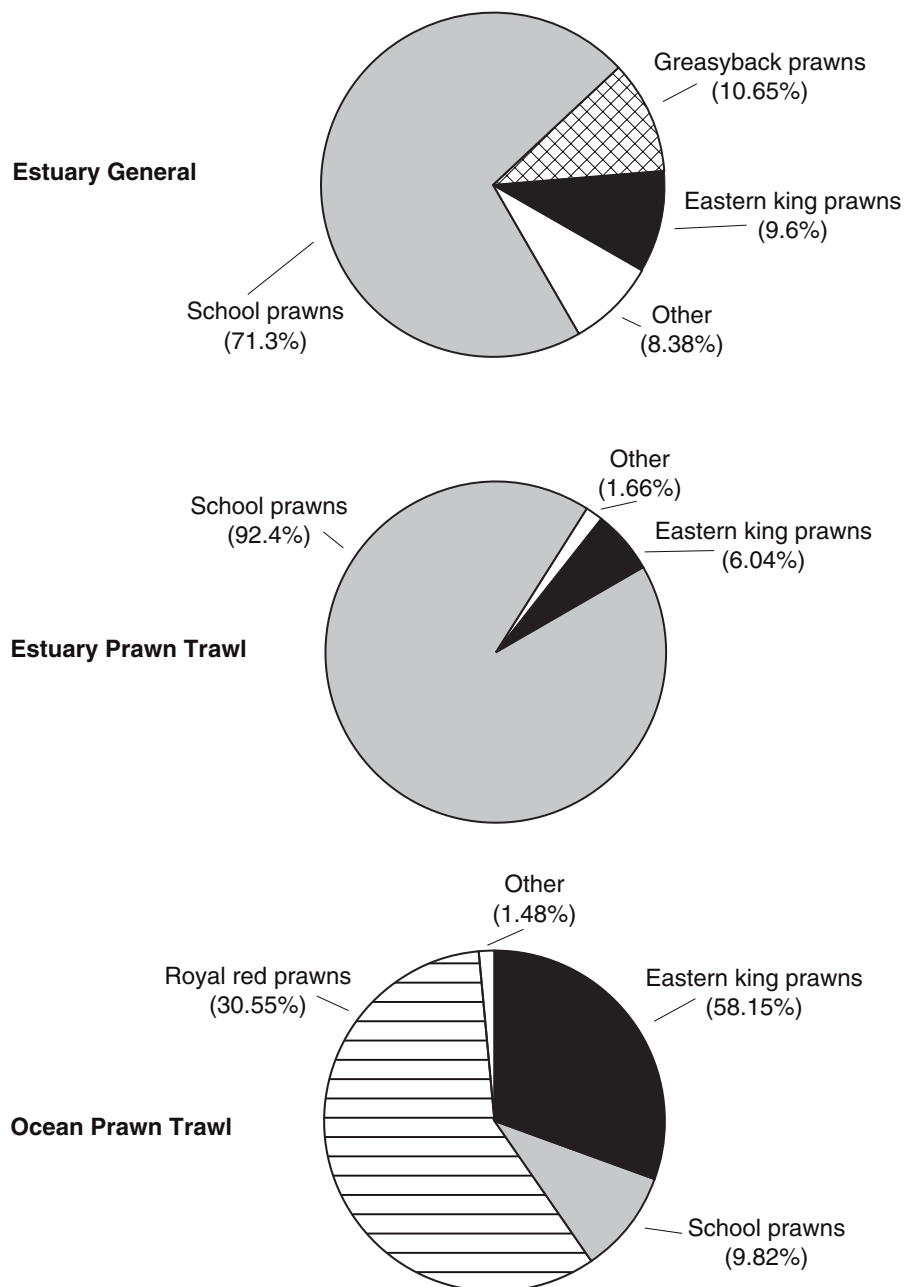
The prawn resources of NSW are fished in estuaries by recreational and commercial fishers and at sea by commercial fishers. The Ocean Prawn Trawl Fishery dominates contributions to the annual reported landings both in terms of weight and value followed by the Estuary General and Estuary Prawn Trawl Fisheries (Figure AE1). The recreational landings of prawns contribute 5% by weight to the total landings (Montgomery and Reid, 1995).



**Figure AE1. Left:** The average contribution by weight of each fishery to the total reported catch of prawns over the 1993/94 to 1998/99 period. **Right:** The average contribution by value of each fishery to the total reported catch of prawns over the 1993/94 to 1998/99 period.

The “Other” category is comprised of catches of prawns from methods other than those included in the three fisheries (e.g. catches of prawns reported by fishers to have been caught by handling).

School prawns (*Metapenaeus macleayi*), dominate the landings of the two estuary fisheries (Figure AE2). Eastern king prawns (*Penaeus plebejus*) contribute most to the remaining landings of the Estuary Prawn Trawl Fishery and small quantities of greasyback (*Metapenaeus bennettiae*) and tiger prawns (*Penaeus esculentus*) are also caught. The study by Montgomery and Reid (1995) showed that in general the catch of recreational prawners was made up almost entirely of eastern king prawns, but there may be exceptions to this where school prawns comprise a considerable proportion of the catch.

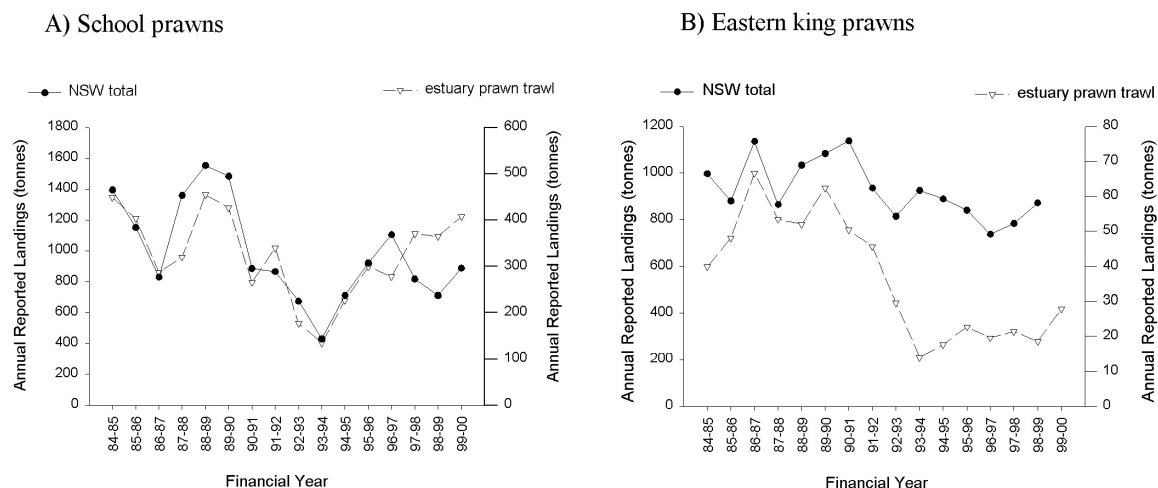


**Figure AE2.** The contribution by weight that each fishery contributes to the total catch of the main prawn species over the 1993/94 to 1998/99 period.

## a) Stock level and dynamics

### *Landings, effort and catch rates*

Commercial fishers were not required to report separate catches for each fishing method prior to 1997-98, making it difficult to accurately determine patterns in landings, effort and catch per unit effort (CPUE) per fishery. Given that the Estuary Prawn Trawl Fishery is a single method fishery it is possible to associate catch with fishing method. However these landings do not include catches where more than one fishery has been used in a given month and may underestimate true values. Values, for the Estuary Prawn Trawl Fishery from 1997-98 on are more accurate as changes in the method of reporting commercial landings removed this problem.



**Figure AE3.** Total annual reported landings of (A) school prawns and (B) eastern king prawns across both all commercial fisheries in NSW and the Estuary Prawn Trawl Fishery alone.

(Note: Due to changes in the system of reporting commercial catches Estuary Prawn Trawl Fishery values may be an underestimate prior to 1997-98).

The Estuary Prawn Trawl Fishery contributed the most (48%) to commercial landings of school prawns across the State over the 1997-98 and 1998-99 period (see Figure AB9(a)). Statewide annual reported commercial landings of school prawns since 1984-85 have fluctuated showing a downward trend (Figure AE3(a)). Patterns in annual reported school prawn landings by the Estuary Prawn Trawl Fishery over the same period were similar to those of the State (Figure AE3(a)).

During 1997-98 and 1998-99, commercial landings of eastern king prawns across NSW were mostly taken by the Ocean Prawn Trawl Fishery (91%) followed by the Estuary General (6%) and Estuary Prawn Trawl Fisheries (2%) (see Figure AB26(a)). Statewide annual reported commercial landings of eastern king prawns since 1984-85 have fluctuated to a peak in 1990-91 and have since generally declined (Figure AE3(b)). Patterns in annual reported eastern king prawn landings by the Estuary Prawn Trawl Fishery over the same period were similar to those of the State, with landings prior to 1991-92 being greater than those afterwards (Figure AE3(b)).

### ***Spawning stock level***

The greatest abundance of female eastern king prawns capable of spawning (Courtney *et al.*, 1995) occurs northwards from Ballina (28° 52' S) to Swains Reef (21° 05' S) (Montgomery and Reid, 1995). No data on the distribution and abundance of spawning stocks for school prawns are available. There are no data about the relative abundance of the breeding stock of eastern king prawns available.

### ***Current exploitation status***

Both species of prawns primarily targeted by the Estuary Prawn Trawl Fishery (school and eastern king) are fully fished, i.e. the current catches are sustainable and close to optimum levels.

There have been no comprehensive stock assessments of school prawn populations. Patterns in relative abundance suggest that the abundance of school prawns in ocean waters may be declining. This may have implications for the size of the spawning stock, since adult school prawns are found primarily in ocean waters.

Eastern king prawns constitute a unit stock along the east coast of Australia. The species is exploited by both recreational and commercial fishers. The basic conclusion by Glaister *et al.* (1990) from investigations of eastern king prawns in waters off northern NSW was that prawns were being exploited at a very high level and that further increases in fishing effort would cause declines in catch per operator. Montgomery (2000) concluded that the eastern king prawn resource was being exploited at about the level of maximum sustainable yield but that prawns were being caught at sizes that were far smaller than the optimal sizes at first capture. Results from modelling the population suggested that the optimum size at first capture for eastern king prawns is within the ranges of 28-40 mm Carapace Length (CL). Increasing numbers of small prawns are being caught, as offshore fleets fish further southwards and fishing pressure from recreational and commercial fishers in estuaries increases.

Results from the model by Gordon *et al.* (1995) suggested that there may be both biological and economic benefits in allowing eastern king prawns from estuaries in certain areas to move to ocean waters before being caught.

### ***Estimation methods and reliability***

Glaister *et al.* (1990) and Gordon *et al.* (1995) presented yield per recruit models for the eastern king prawn whilst Montgomery (2000) provided an assessment of the eastern king and school prawn stocks. Ruello (1973b) and Glaister (1978a) showed that annual reported landings of school prawns from the Hunter and Clarence Rivers respectively, were associated with the level of river discharge, rather than to fishing effort.

## **b) Population structure and life cycle behaviour**

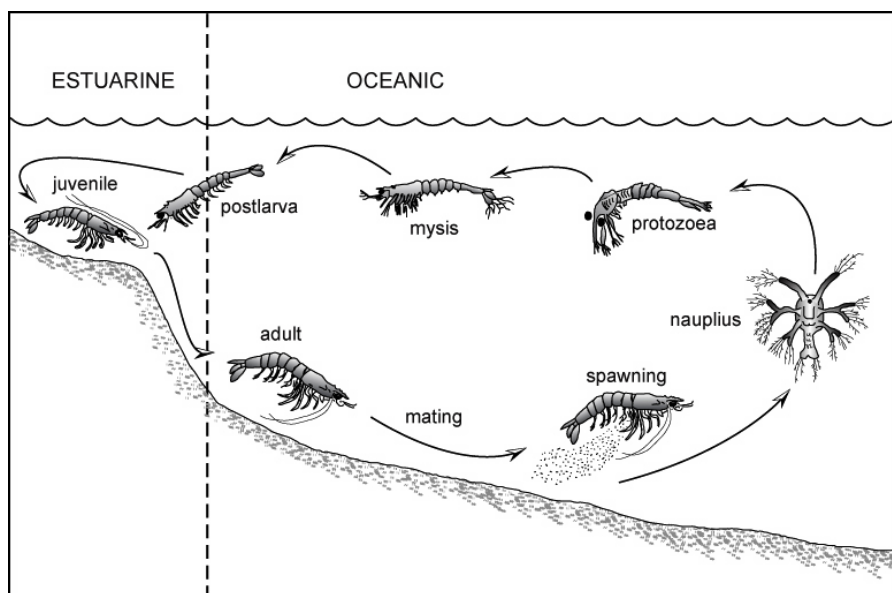
Figure AE4 shows a generalised life cycle of a prawn. School prawns live for probably no more than two years whilst eastern king prawns live for three or perhaps more. Both eastern king and school prawns have a similar estuarine phase to their life cycle, with the exception that school prawns are far more tolerant to waters of low salinity than eastern king prawns and so are distributed further upstream than the latter species. Both species are found in greatest numbers on vegetated habitat, but they are also found on bare substrate. Considering the proportional area of bare to vegetated substrate in an estuary, the latter should not be discounted as a habitat for juvenile prawns.

School prawns emigrate from estuaries as adolescents or adults and may spawn in waters of oceanic characteristics within the estuary. Once at sea school prawns stay within a radius of about 120 km of the estuary from which they emigrated and are distributed on grounds in waters to depths of about 50 m. The species reaches maturity at around 25 and 23 mm CL for males and females, respectively, but these sizes may vary between stocks, and spawns in waters of oceanic quality to depths of about 50 m (Ruello, 1971).

In contrast eastern king prawns emigrate from estuaries as adolescents. They do not spawn in estuaries but rather once at sea migrate over distances of sometimes in excess of 1000 km in a northerly direction to spawn in waters off northern NSW to central Queensland (Montgomery, 1990; Montgomery *et al.*, 1995). The size of maturity for this species is around 38 mm CL and 42 mm CL for males and females, respectively. Eastern king prawns are distributed on grounds in waters out and beyond the continental shelf.

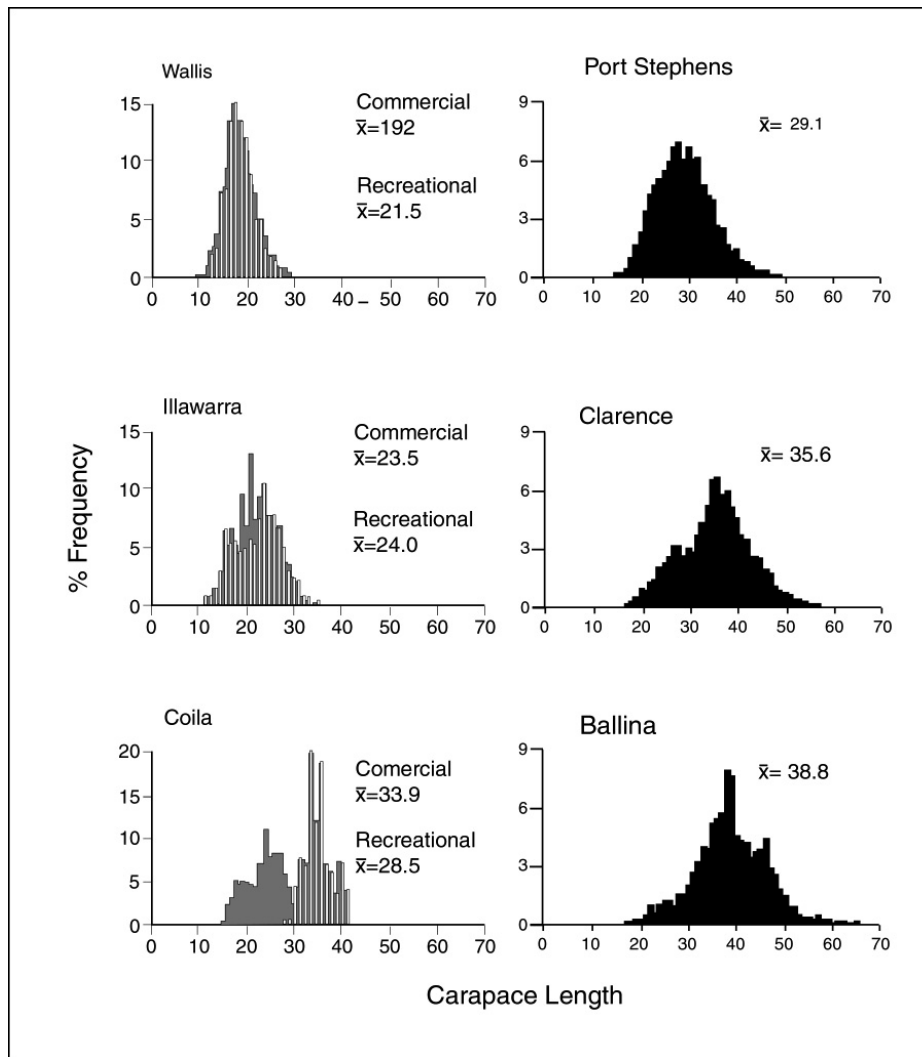
It is these differences in the oceanic phase of the species' life cycles that lead scientists to recommend that these species be managed differently. Because school prawns stay primarily around the estuary from which they emigrate scientists recommend that this species be managed as a series of

unit stocks that centre about the main estuaries along the coast of NSW. On the other hand, because eastern king prawns from Victoria to Queensland move in a northerly direction along the east coast of Australia and because most spawners are found in the northern waters of the species' distribution, scientists recommend that this species be managed as one stock.



**Figure AE4.** A generalised life cycle of eastern king and school prawns.

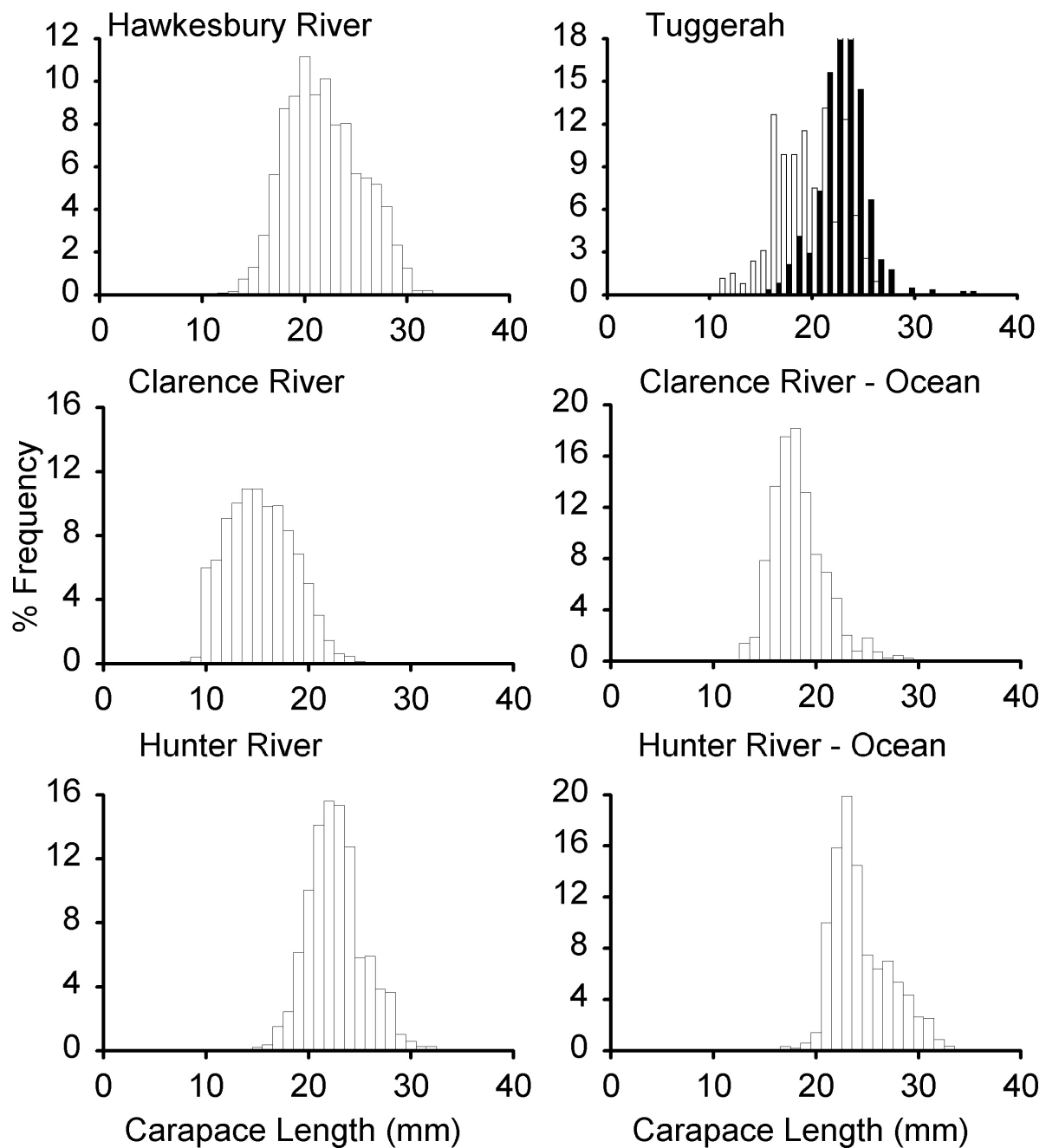
Eastern king prawns first appear in the catches of the Estuary General Fishery and the recreational fishery as juveniles around the size of 12 mm CL (Figure AE5). The distribution of sizes of prawns in the catch will depend upon the geological-features and geographic locality of the estuary where the prawns were caught. Estuaries in more southern waters have larger prawns as do those which open intermittently to the ocean (e.g. Coila Lake, Figure AE5). Eastern king prawns are large in the more northern, ocean waters off NSW, as the species moves northwards.



**Figure AE5.** Distributions of sizes of eastern king prawns from samples of catches taken from fishers operating in estuaries during 1991 to 1994 (left hand graphs) and in ocean waters during 1990 to 1992 (right hand graphs).

(**Note:** The distribution of sizes of prawns in samples from both recreational (white bars) and commercial (black bars) fishers operating in estuaries are shown. The average size of prawns in samples from the catches of each fishery component are also shown. Note the estuarine data are based upon the Estuary General Fishery and are shown here only as an example of the sizes of eastern king prawns found in estuaries).

The distribution of sizes of school prawns caught in the Estuary Prawn Trawl Fishery varies between estuaries (Figure AE6). The species first appears in catches at around 10 mm CL. In ocean waters prawns as large as around 35 mm CL are caught. In the Clarence region, larger prawns were caught in the ocean, while the Hunter region showed no distinct pattern.



**Figure AE6.** Distributions of sizes of school prawns from samples of catches taken from fishery independent surveys.

(**Note:** These surveys were conducted on the school prawn populations of the Hawkesbury, Clarence and Hunter Rivers during 1991 to 1994 and ocean areas during 1990 to 1992. Shown also are the size distributions of school prawns in samples from catches of the recreational (black bars) and Estuary General (white bars) Fisheries on Tuggerah Lakes).

### c) Spatial and temporal distribution

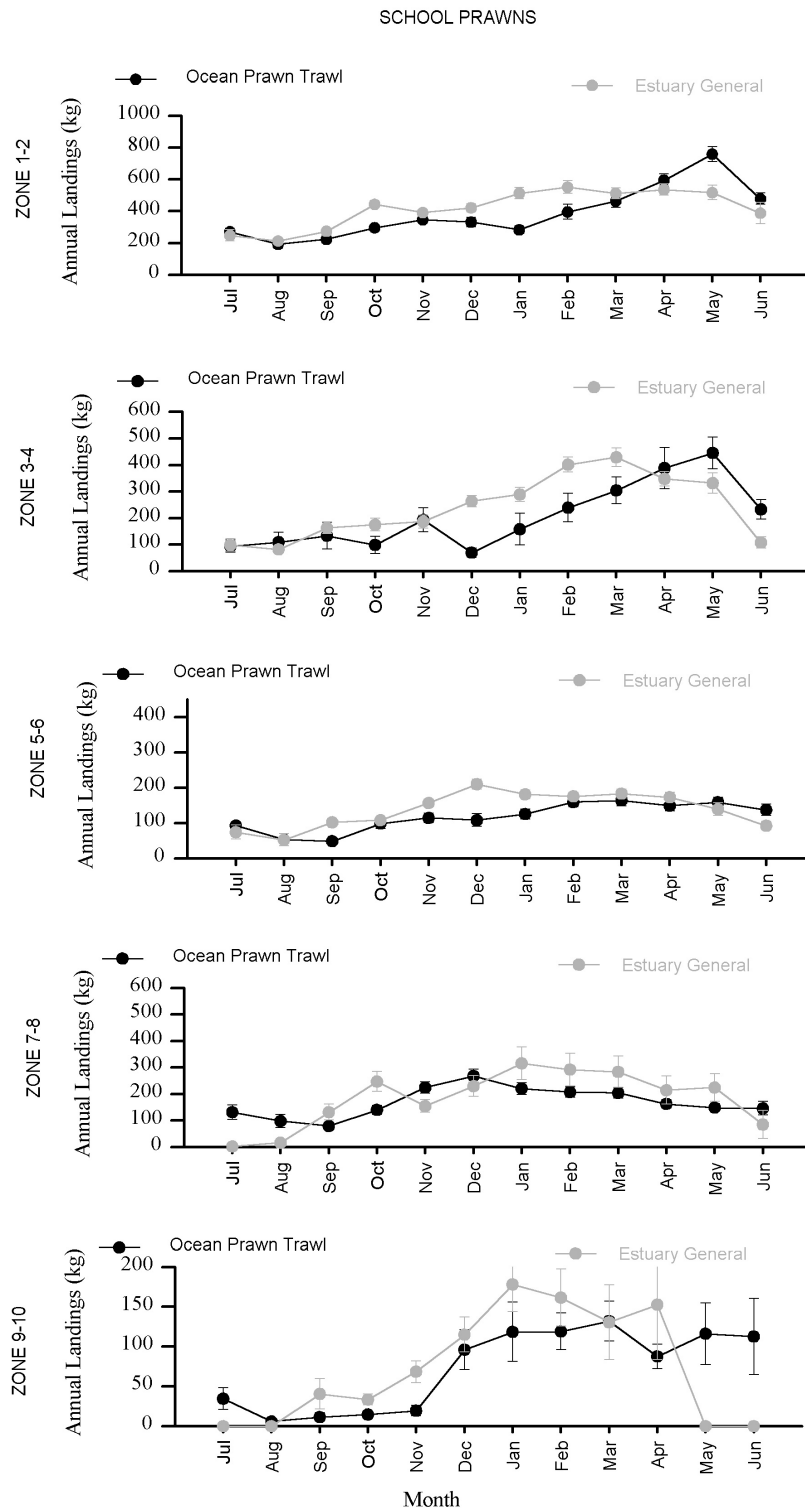
The Ocean Prawn Trawl and Estuary General (prawn) fisheries can operate in all fishing zones along the NSW coast during the whole year. Figures AE7 and AE8 show only the seasonality and distribution of landings of school prawns and eastern king prawns along the coast by these fisheries. The figures, being reliant on catch return data that is influenced by many factors – including effort,



give only an indication of what the seasonality and distribution of these species along the coast might be. Estuary prawn trawl values are not shown as trawling does not occur in all zones along the coast and does not occur all year in most of the trawled estuaries. However, zones where estuarine prawn trawling does occur, and thus a greater number of these species are likely to be caught include zones 1, 5, 6 and 7.

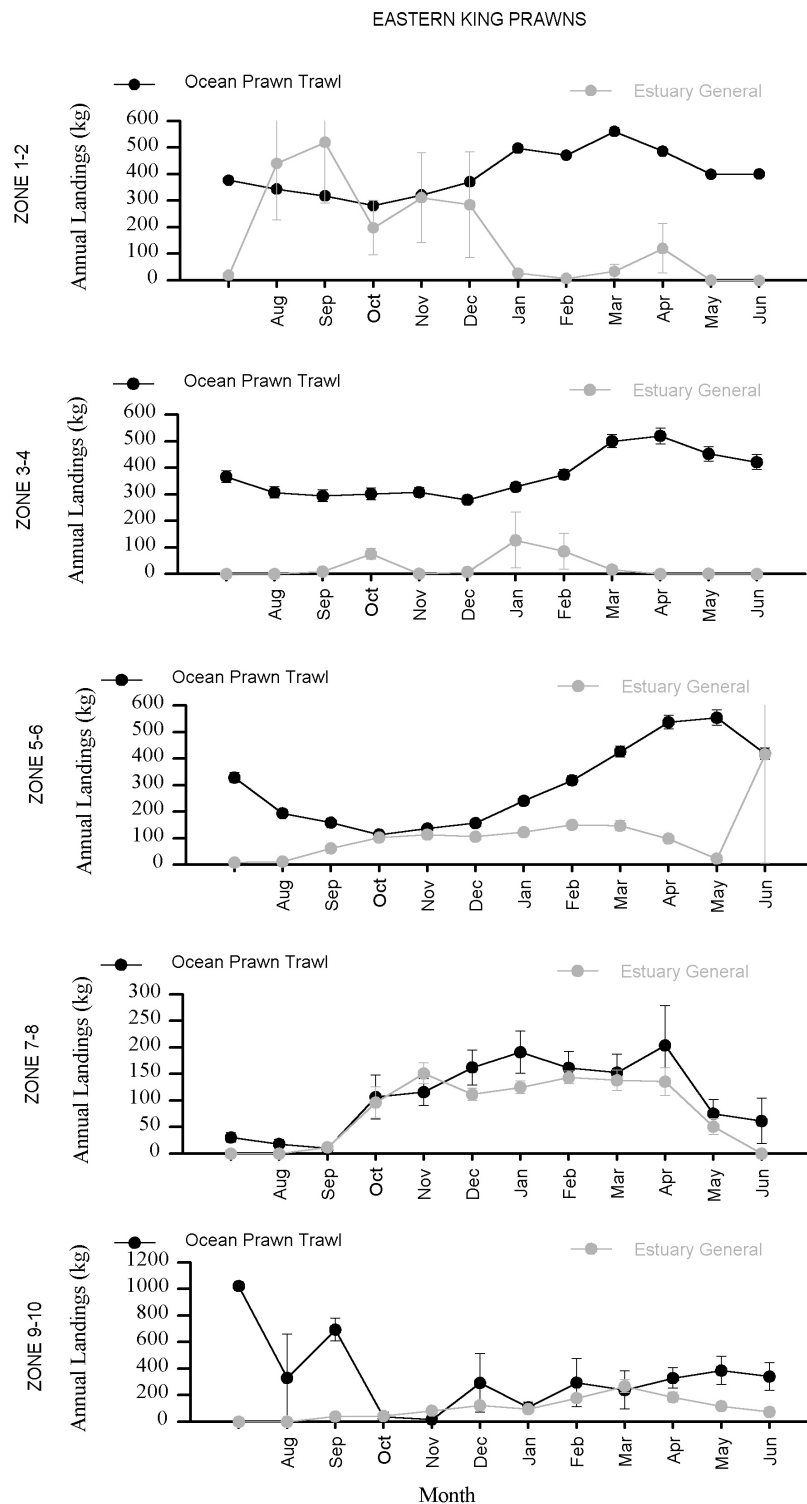
School prawns are caught all year round and in all zones along the coast (Figure AE7). The greatest annual commercial reports by weight in the Ocean Prawn Trawl and Estuary General Fisheries occur in the northern fishing zones (1 to 4). The seasonality of the annual reported landings by the Estuary General Fishery varies between zones but overall in most zones the species is landed in greatest weight between January and June. The season for school prawns in ocean waters in zones 1 to 6 is generally later in the year than in the adjacent estuaries, as the prawns move from the estuarine environment to sea over summer. This contrast in seasons between estuary and ocean is not as pronounced for zones 7 to 10, but in zones 9 and 10 oceanic landings are highest during autumn.

Eastern king prawns are caught along the whole coast of NSW, and like school prawns annual reported commercial landings by weight in the Ocean Prawn Trawl and Estuary General Fisheries are greatest in the northern fishing zones (1 to 6) (Figure AE8). Whilst the seasonal pattern of landings from estuaries in zones 1 to 6 is variable the greatest landings from the ocean occur during March to July, when the prawns have emigrated from the estuaries and are moving northwards along the coast. In zones 7 and 8 the patterns in annual reported landings between estuaries and oceans is similar, being highest between November and April. In zones 9 and 10 the greatest annual landings from estuaries occur during summer whilst those from the ocean show no consistent pattern.



**Figure AE7.** Spatial and temporal distribution of mean annual reported landings of school prawns from the Estuary General and Ocean Prawn Trawl Fisheries in fishing zones along the NSW coast during 1993-1999.

(Note: The vertical bars show the standard error about each mean value)



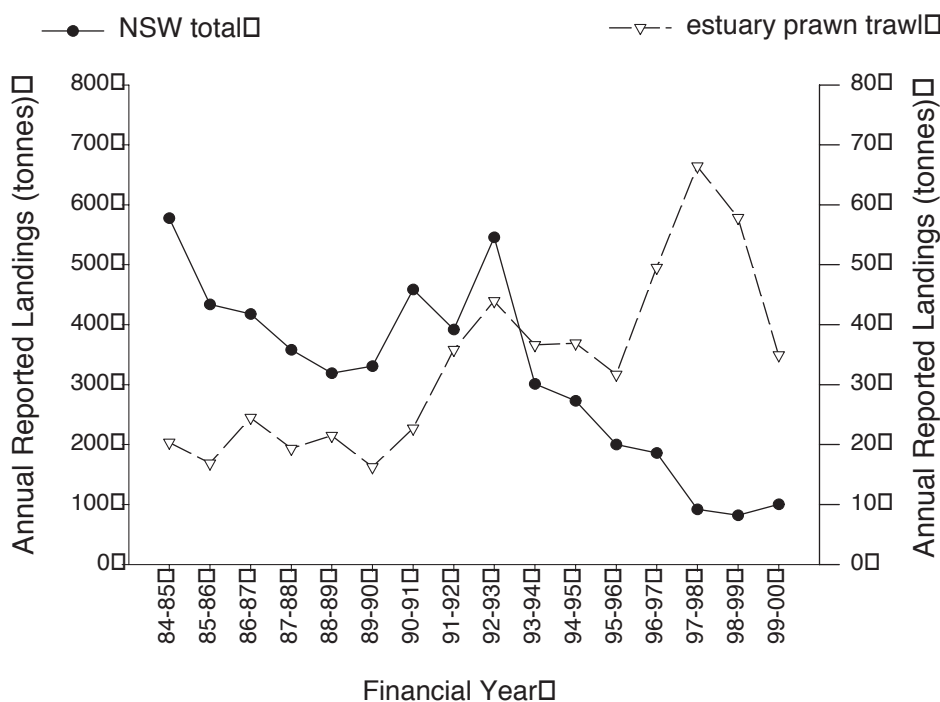
**Figure AE8.** Spatial and temporal distribution of mean annual reported landings of eastern king prawns from the Estuary General and Ocean Prawn Trawl Fisheries in fishing zones along the NSW coast during 1993-1999.

(Note: The vertical bars show the standard error about each mean value)

## 2. Squid

Commercial fishermen in NSW are required to record landings of squid by group, rather than species. The main squid species contributing to these commercial landings include *Loliolus noctiluca*, *Photololigo etheridgei*, *Photololigo sp.*, and *Notodarus gouldi*. During 1997-98 to 1998-99, the Estuary Prawn Trawl Fishery was one of the main contributors to the reported landings of squid in NSW (36%) along with the Ocean Prawn Trawl (28%) and Estuary General (22%) Fisheries (see Figure AB42(a)). Of these catches, 99% of squid landings by the Estuary Prawn Trawl Fishery were taken at the Hawkesbury River where squid is targeted by the fishery. A current study by the University of Sydney on the Hawkesbury River squid fishery has found their catch to consist of two species, *Photololigo etheridgei* and *Loliolus noctiluca* (K. O'Donnell, Sydney University, pers. comm.).

There is little information on the biology of these species. No research has been completed in NSW and there has been no formal stock assessment of squid species. Research from the University of Sydney will provide life history information on *Photololigo etheridgei*, preliminary results suggest that both males and females become sexually mature at a mantle length of about 10 cm, and that mature (and presumably spawning) squid appear to be present throughout the year (K. O'Donnell, Sydney University, pers. comm.).



**Figure AE9.** Total annual reported landings of squid species across both all commercial fisheries in NSW and the Estuary Prawn Trawl Fishery alone.

(Note: Due to changes in the system of reporting commercial catches Estuary Prawn Trawl Fishery values may be an underestimate prior to 1997-98)

Annual reported commercial landings of squid species across NSW have dramatically declined, fluctuating from this pattern only during the early 1990s (Figure AE9). Contrary to this pattern commercial catches of squid in the Hawkesbury River have increased dramatically since 1996-97, probably an indication of the development of this fishery, and have declined in 1999-2000 (Figure AE9).

### 3. Other species

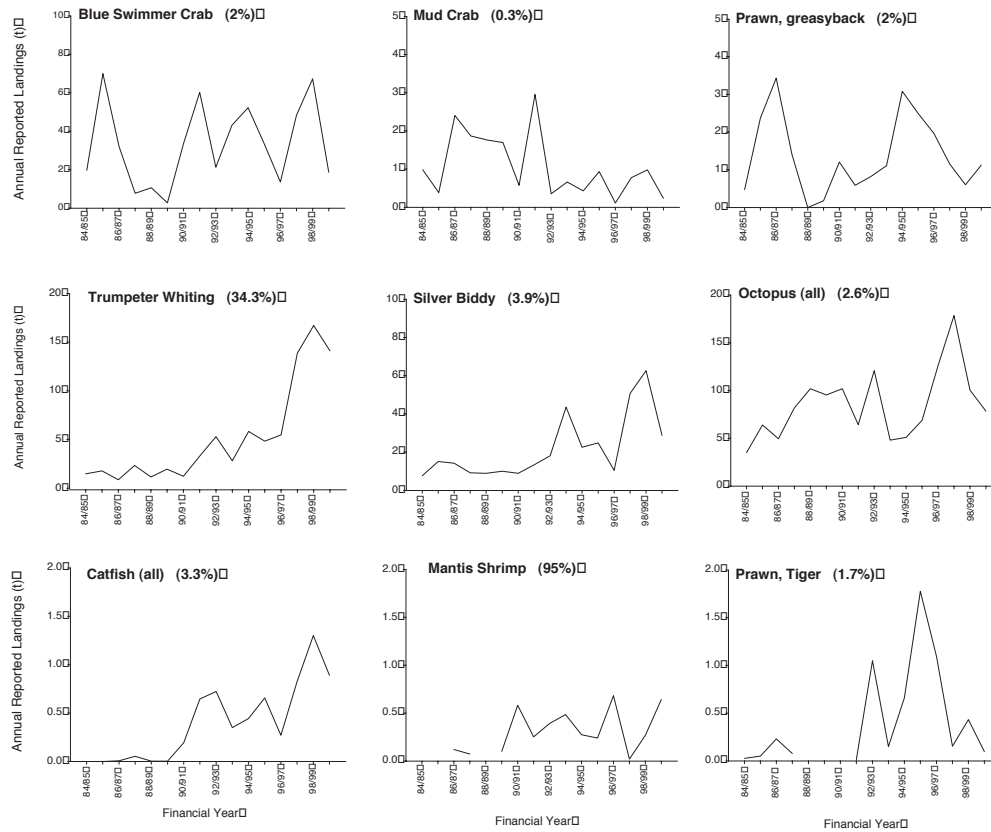
There is very limited biological and fishery-related information available for the species listed in Table E1 with an ‘unknown’ exploitation status. These species are blue swimmer crab, mud crab, greasyback prawn, trumpeter whiting, silver biddy, yellowtail, mantis shrimp, tiger prawn, pike, john dory, black sole, sand crab, striped trumpeter, whitebait, hairtail and octopus, flounder and catfish species. The minimum, maximum and average reported landings of these species retained by the Estuary Prawn Trawl Fishery is given in Table AE1. Trends in reported estuary prawn trawl landings for each of these species over the past 16 years are shown in Figure AE10. Of these landings, those of trumpeter whiting represent a considerable proportion of total commercial landings in the State (34.3% during 1997-2000), as do landings of mantis shrimp (95% during 1997-2000) however, very little of this species is landed commercially.

Reported catches of trumpeter whiting, silver biddy, flounder (all species combined) and octopus (all species combined) by the Estuary Prawn Trawl Fishery have increased over the past 16 years (Figure AE10). In particular, reported catches of trumpeter whiting have risen dramatically since 1996-97, and reported catches of flounder (all species combined) have risen dramatically since 1989-90. Whilst reported catches of blue swimmer crab, mud crab, greasyback prawn, tiger prawn, mantis shrimp, hairtail, john dory and catfish (all species combined) have fluctuated throughout the past 16 years, there has been no consistent downward or upward trend in estuary prawn trawl catches (Figure AE10). Reported catches of whitebait (all species combined), pike, black sole and trumpeter by the Estuary Prawn Trawl Fishery began in the early 1990s and have fluctuated since (Figure AE10). Reported catches of yellowtail by the Estuary Prawn Trawl Fishery increased from a low in 1988-89 and have dramatically declined in 1999-2000 (Figure AE10). Reported catches of sand crab by the Estuary Prawn Trawl Fishery have dramatically declined since 1990 (Figure AE10).

Fishery sampling of trumpeter whiting, silver biddy and yellowtail is currently underway. Research proposals to granting bodies are currently being reviewed for work on blue swimmer crab.

**Table AE1.** The minimum, maximum and average annual reported landings (tonnes) over the 1984-85 to 1999-2000 period for the species retained by the Estuary Prawn Trawl Fishery whose current exploitation status (Table E1) is unknown.

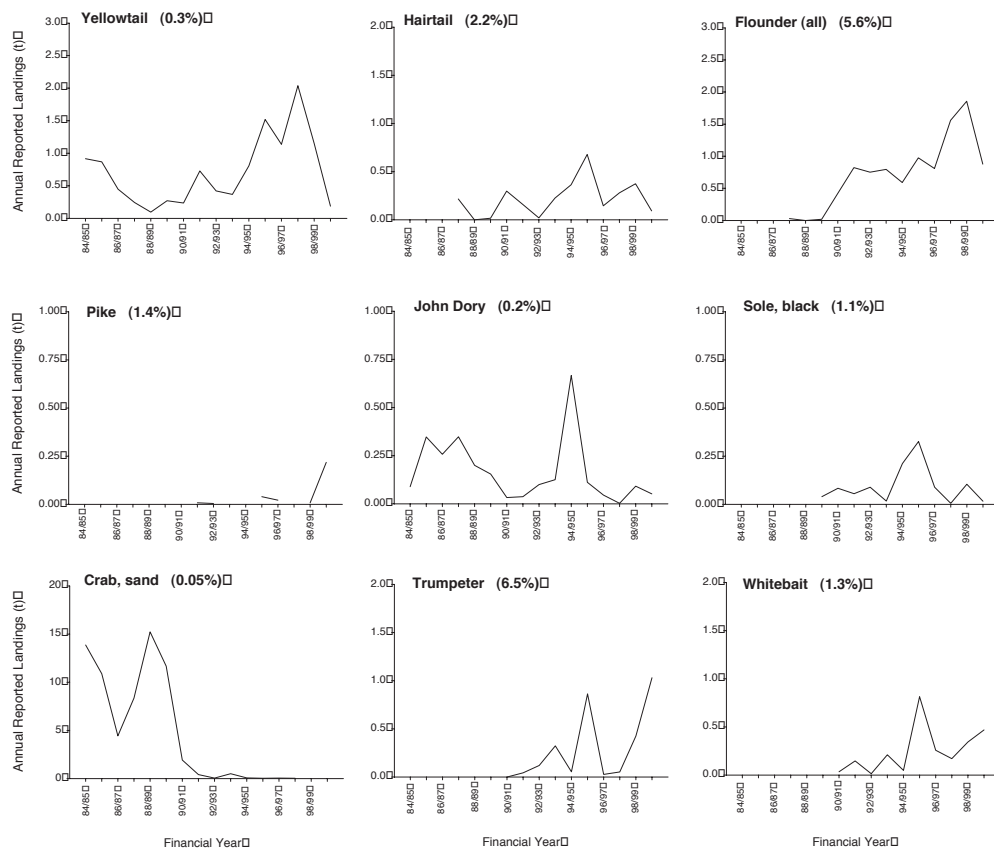
| <i>Species</i>                              | <i>Minimum</i> | <i>Maximum</i> | <i>Average</i> |
|---------------------------------------------|----------------|----------------|----------------|
| Trumpeter whiting                           | 13.9           | 25.7           | 18.8           |
| Octopus (at least 3 species)                | 8.1            | 18.2           | 12.1           |
| Silver biddy                                | 5.1            | 6.4            | 5.9            |
| Blue swimmer crab                           | 2.7            | 6.7            | 4.8            |
| Flounder (at least 2 species)               | 1.5            | 1.9            | 1.6            |
| Yellowtail                                  | 9.2            | 2              | 1.4            |
| Greasyback prawn                            | 6              | 1.1            | 1              |
| Catfish (at least 3 species)                | 0              | 0.723          | 0.9            |
| Trumpeter                                   | 0.02           | 1.1            | 0.5            |
| Mud crab                                    | 0.08           | 1              | 0.4            |
| Hairtail                                    | 0.3            | 0.4            | 0.3            |
| Whitebait (glass fish) (at least 2 species) | 0              | 0.8            | 0.2            |
| Mantis shrimp (at least 3 species)          | 0              | 0.7            | 0.3            |
| Tiger prawn                                 | 0              | 1.8            | 0.4            |
| Long-finned pike                            | 0              | 0.2            | 0.02           |
| John dory                                   | 0.002          | 0.7            | 0.2            |
| Black sole                                  | 0              | 0.3            | 0.07           |
| Sand crab                                   | 0              | 15.2           | 4.2            |
| Bullseye (at least 2 species)               | 0              | 0.01           | 0.0007         |



**Figure AE10.** Trends in reported landings by the Estuary Prawn Trawl Fishery over the 1984/85 to 1999/00 period of the retained species whose current exploitation status (Table E1) is unknown.

(**Note:** Due to changes in the system of reporting commercial catches Estuary Prawn Trawl Fishery values may be an underestimate prior to 1997/98. Values in brackets indicate the percentage of total commercial NSW landings contributed by the Estuary Prawn Trawl Fishery for that species during the 1997-2000 period. A graph for bullseyes was not produced as these species were only commercially reported during one year of the 1984/2000 period)

Figure AE10 cont'd



## **APPENDIX F**





## APPENDIX F1. ESTUARY CHARACTERISTICS

The estuaries trawled by the Estuary Prawn Trawl Fishery have different shapes, sizes and geological origins, and these factors are largely responsible for determining the distribution and abundance of physical habitats and ecological assemblages.

### 1. General Characteristics

Estuaries represent a ‘mixing zone’ between completely sheltered freshwaters and the open ocean (e.g. Das *et al.*, 2000). The forces driving this mixing include tides, wind, waves and river runoff (O’Loughlin *et al.*, 1999), although the relative importance of each of these varies according to estuary type and the location within an estuary (Roy *et al.*, 2001). Tidal currents are often dominant, depending on entrance condition and bathymetry. Gravitational circulation, caused by density differences between fresh and salt water may also be important in estuaries that are subject to large volumes of river runoff. Wind-driven circulation is most important in large shallow estuaries with small tidal ranges and low freshwater inflows (O’Loughlin *et al.*, 1999), although sizeable wind-waves (sufficient to cause long shore currents, sediment transport and/or foreshore erosion) may form wherever sufficient fetch is available. Ocean swell may also be a factor near an estuary’s entrance, particularly during rough sea conditions.

### 2. Main Estuary Types Occurring in NSW

There are at least 950 water bodies joining the Tasman Sea along the New South Wales seaboard (Williams *et al.*, 1998), however, the majority of these are very small and only intermittently open to the sea. Only 130 have a water area greater than 0.05km<sup>2</sup> and are regularly referred to as estuaries. Various attributes of these 130 estuaries have been documented by Bell and Edwards (1980), West *et al.* (1985) and Roy *et al.* (2001).

Based on geological criteria and the degree of marine influence, Roy *et al.* (2001) recognise five coastal water body groupings in eastern Australia: (1) Bays; (2) Tide-dominated estuaries; (3) Wave-dominated estuaries; (4) Intermittent estuaries; and (5) Freshwater bodies. Within these groups are 13 water body types, most of which occur in NSW (Roy *et al.* 2001). This classification scheme builds on the earlier work of Roy *et al.* (1980) and Roy (1982, 1984). Whilst truly estuarine environments (and the majority of NSW estuaries) fall into groups 2 to 4, the remaining groups include types that either comply with Day’s (1980) definition of an estuary, or are directly linked to estuarine environments at least part of the time. The various estuary types (at least those with a water area greater than 0.05km<sup>2</sup>) differ in their frequencies of occurrences and respective distributions along the NSW coastline (Roy, 1982; West *et al.*, 1985; Roy *et al.*, 2001).

#### a) Bays or open ocean embayments

Ocean embayments are rare (five in total) and, with the exception of Sydney’s Botany Bay, are all located on the south coast: Jervis Bay; Ulladulla Harbour; Batemans Bay; and Twofold Bay. These are characterised by marine waters and have little freshwater inflow, they are transitional between true estuaries and the coastal ocean. Within such embayments, tides are unimpeded, and ocean swells retain a strong influence well inside the entrance. These estuaries are normally wide and reasonably

deep, and internal currents are therefore usually weak, but considerable wave-induced water movement can occur in the shallows.

## **b) Tide-dominated estuaries**

Tide-dominated estuaries are represented in NSW by drowned valley estuaries such as Broken Bay/Hawkesbury River and Sydney Harbour (Roy *et al.*, 2001). Drowned valley estuaries are also relatively uncommon (eight in total), and are concentrated on the central part of the NSW coast, especially near Sydney (e.g. Broken Bay, Port Jackson, Georges River and Port Hacking). These estuaries are characterised by convoluted shorelines, with deep sheltered tributaries and lots of sheltered bays. These estuaries are subject to most of the oceanic tidal range throughout all but their uppermost reaches. Currents are usually weak within the sheltered bays and tributaries, but may be moderately strong within the main water body, particularly where a point or island impinges on the main tidal flow. Complex tidal circulation patterns involving eddies and back-flows are typical (e.g. Das *et al.*, 2000). Ocean swells normally only penetrate the lower reaches, and river discharge has little influence, except during floods. Drowned valley estuaries are typically larger than the other types of estuary occurring along the NSW coastline (West *et al.*, 1985; Roy *et al.*, 2001).

## **c) Wave-dominated estuaries**

There are 49 wave-dominated estuaries in NSW, and are represented by barrier estuaries such as Lake Macquarie and by interbarrier estuaries such as Tilligerry Creek, Port Stephens, of which there are only six (Roy *et al.*, 2001). The characteristics of barrier estuaries depend greatly on the degree of infilling or maturity (Roy, 1982; Roy *et al.*, 2001).

Immature barrier estuaries, such as Lake Macquarie, Wallis Lake and Brisbane Waters have a wide basin (lagoon) linked to the ocean by a narrow entrance channel, which in most cases remains open to the ocean. In such estuaries, tidal range normally decreases dramatically as one travels upstream through the entrance channel, such that within the basin, the range is usually only a small fraction of that of the open ocean. Tidal currents are strong in the entrance channel, but very weak within the basin itself where local wind waves and wind-induced water movements are the dominant sediment transporting mechanisms. Also, ocean swells are quickly attenuated in the lower end of the entrance channel.

Mature barrier estuaries such as the Clarence, Hunter, Richmond and Shoalhaven Rivers have become infilled to the point where a distinct basin is lacking, the entrance channel configuration continues throughout the estuary. In such cases freshwater input is usually high (probably explaining the high degree of historical infilling) and the main river channel (possibly split into two or more arms) essentially continues all the way to the ocean. Such estuaries have become river dominated (Roy *et al.*, 2001). True wave-domination has been lost, currents (due to a combination of river discharge and tidal action) are normally moderate to strong throughout most of the system, and tidal range decreases only gradually with distance upstream. As in immature barrier estuaries, ocean swells do not penetrate far beyond the entrance. Whilst barrier estuaries occur behind a single coastal sand barrier, interbarrier estuaries occur between two such barriers of differing geological age.

## **d) Intermittent estuaries**

Intermittent estuaries are represented in NSW by saline coastal lagoons such as Smiths Lake and by small coastal creeks such as Harbord Lagoon, Sydney (Roy *et al.*, 2001). There are 57 saline

coastal lagoons in NSW and they are especially common in the south. The larger and/or better known examples include Lake Innes/Lake Cathie, Smiths Lake, Narrabeen Lagoon, Lake Wollumboola, Swan Lake and Coila Lake. Small coastal creeks are quite rare in NSW, with only five examples, all of which are in the northern half of the State.

Intermittent estuaries are similar to the immature barrier estuaries discussed above, except they are only periodically open to the ocean. Due to relatively small catchments and therefore river discharges, beach sand blocks their mouths for much of the time. Openings, usually in the form of a narrow entrance channel, normally occur as a result of heavy rainfall within the catchment, possibly in conjunction with high tides and heavy seas. Such lakes may open naturally, or be opened mechanically to alleviate flood threats (NSW Fisheries, 1999a; O'Loughlin *et al.*, 1999; Roy *et al.*, 2001). Whilst open, their hydrology usually becomes similar to that of immature barrier estuaries. During periods of closure tidal influence ceases, however longer term changes (over weeks or months) in water level may occur according to the balance between inflow and evaporation (NSW Fisheries, 1999a). Intermittent estuaries are typically smaller than the other types of estuary occurring along the NSW coastline (West *et al.*, 1985; Roy *et al.*, 2001).

## **e) Freshwater bodies**

Coastal freshwater bodies are represented in NSW by brackish barrier lakes such as Myall Lakes, of which there are only four, and by backswamps such as Everlasting Swamp in the Clarence River system. Many of the backswamps have been drained or modified. These water body types have at least occasional linkages (particularly during floods) to either the sea or a true estuary. These linkages facilitate the passage of nutrients, organic matter and aquatic organisms.



## APPENDIX F2. ESTUARINE HABITAT DESCRIPTIONS

### 1. Seagrass

Seagrasses are flowering plants that live and reproduce completely submerged in seawater (King, 1981a; West, 1989). They are rooted in the sediments, with their leaves appearing above the ground. They produce flowers and seeds, similar to terrestrial grasses (Keough and Jenkins, 1995). Six species of true seagrass are found within NSW (West, 1989). Strapweed (*Posidonia australis*) has straight broad leaves and grows from just below the water surface to a depth of 35 m, largely dependent upon water clarity (Keough and Jenkins, 1995). Their leaves are often up to 60 cm long and 10-15 mm wide. Of eight known from around Australia, only one species occurs in NSW. There are three species of narrow-leaved seagrasses, commonly called eelgrass, found in NSW. Their leaves are generally only a few millimetres wide and less than 30 cm long. These include *Zostera capricorni*, *Z. muelleri* and *Heterozostera tasmanica*. Eelgrass is found in very shallow water, often on mudflats that are exposed at low tide (Keough and Jenkins, 1995). The other true seagrasses are referred to as paddleweeds and in NSW include the species *Halophila ovalis* and *H. decipiens*. They have small, oval-shaped leaves generally less than 5 cm long. Unlike the other seagrasses, these do not form extensive beds, but are generally found on their own in deeper water or mixed in with beds of the other seagrasses (Keough and Jenkins, 1995). Although not a true seagrass, sea tassel (*Ruppia maritima*, *R. megacarpa* and *R. polycarpa*) is often considered as such and is included here. Unlike the true seagrasses, sea tassel does not live in seawater, preferring fresh to brackish conditions and is usually pollinated above the water surface (West, 1989).

Seagrass is widely recognised as an important habitat for juvenile fish (e.g. SPCC, 1981a; Pollard, 1984; Bell and Pollard, 1989; Connolly, 1994), but it serves many more roles than the mere provision of food and habitat for species of economic value. They are also reported to: prevent erosion by restricting water movement and binding sediment (Scoffin, 1970; Fonseca *et al.*, 1982); form the basis of food webs through high productivity and providing detritus (Borowitzka and Lethebridge, 1989; Hillman *et al.*, 1989); provide surfaces for colonisation by epiphytes and periphyton (Harlin, 1975; Pollard and Moriarty, 1991); and trap and recycle nutrients (Hemminga *et al.*, 1991). Some studies have also reported the importance of detached seagrass supporting abundant fish communities adjacent to the beaches upon which it washes up on, forming accumulations known as wrack (Lenanton *et al.*, 1982). In northern Australia, seagrasses form a major component of the diet of dugongs and turtles, but in more temperate environments such as NSW, few animals actually directly consume seagrass (Klumpp *et al.*, 1989). Rather, as stated above, its importance to most megafauna is in the provision of food and habitat for the species upon which they feed.

The following assemblages of organisms are found associated with seagrass beds. Periphyton consists of microscopic organisms such as bacteria and single-celled plants, which cover the seagrass blades. Epiphytes are multi-celled plants, such as algae, that cover the leaves. Infauna are animals that live in the sediment and rhizomes, including worms, bivalve molluscs (e.g. pipis) and crustaceans (e.g. nippers or yabbies). Mobile epifauna are usually smaller, mobile animals associated with the surface of the sediment, among debris or on the blades, and include gastropod molluscs (e.g. snails) and crustaceans (e.g. crabs and amphipods). Sessile epifauna are animals attached permanently to stems or

leaves. Epibenthic fauna are larger, often predatory, mobile animals that are associated loosely with the seagrass bed itself rather than individual leaves, and include crabs, prawns and fishes.

Seagrasses provide an important resource for many species targeted by the Estuary Prawn Trawl Fishery. While fish rarely eat seagrass itself, they do eat attached epiphytes and eat the small invertebrates that live among the seagrass (Bell and Pollard, 1989). Many species of fish of economic importance, including marine species, arrive in seagrass beds as small juveniles, including yellowfin bream, tarwhine, snapper, luderick, blue groper, silver biddy and several leatherjackets. Other, non-commercial species that are commonly associated with seagrasses include pipefishes (Syngnathidae), gobies (Gobiidae), scorpion fishes (Scorpaenidae) and toadfishes (Tetraodontidae) (Lincoln Smith and Jones, 1995). Some species remain in the seagrasses their entire lives, whereas some species move to other habitats, including other species of seagrass, as they grow. Different species of seagrasses are known to support different assemblages of fish and invertebrates (SPCC, 1981a; Middleton *et al.*, 1984), and other studies have also reported that the position of seagrass beds within an estuary is also important. Within the larger estuaries, beds closest to the mouth of the estuary supported a greater abundance and diversity of juveniles than those further upstream (Bell *et al.*, 1988; Hannan and Williams, 1998; McNeill *et al.*, 1992).

Almost all estuaries have some cover of seagrass, but four estuaries account for more than 50% of the total area of seagrass in NSW: Wallis Lake 30%; Clarence River 15%; Lake Macquarie 10%; and Tuggerah Lakes 7%. These and other barrier estuaries contain most of the larger seagrass beds, the exception is Jervis Bay (6%), which is an open ocean embayment. Those estuaries thought to have little or no seagrass are predominantly very small, intermittently open estuaries. It is not only the distribution that is important, it is also the composition and quality of the seagrass beds. For example, in poorly flushed estuaries such as Tuggerah Lakes, some seagrass has been smothered by algae, whilst in Botany Bay, altered wave regimes have caused sea bed erosion and seagrass loss (West, 1989; Keough and Jenkins, 1995). In other estuaries, the species composition of seagrass beds has been altered. Eelgrass has replaced strapweed in parts of Botany Bay (Keough and Jenkins, 1995), and paddleweed has replaced eelgrass in parts of Lake Macquarie (King, 1986). As discussed above, such changes have implications for the types of assemblages that beds, and ultimately estuaries, can support.

## 2. Mangroves

Mangroves are trees and shrubs that grow in soft sediments in the intertidal zone of estuaries, generally in sheltered areas where silt can accumulate. They usually form dense forests when conditions are optimal, but can exist as small, scattered trees on rocky shores in extremely sheltered areas (Chapman and Underwood, 1995). Mangroves usually spread their roots out widely in the upper layers of sediment, as opposed to vertically, in order to maximise exposure to oxygen and to enhance stability in otherwise unstable substrata (Chapman and Underwood, 1995). Many mangroves also have aerial roots called pneumatophores, which arise vertically out of the sediment and absorb oxygen and other gases. It is thought that sub-optimal growing conditions, particularly in polluted environments, results in an increase in the numbers of pneumatophores (Hutchings and Saenger, 1987). In order to survive in saline environments, mangroves either secrete salt through glands in their leaves, exclude salt via a filtering system or accumulate it in old leaves (Chapman and Underwood, 1995). Of over thirty species known in Australia, five have been recorded in NSW (West *et al.*, 1985). These include the grey (*Avicennia marina*), river (*Aegiceras corniculatum*), milky (*Excoecaria agallocha*), spider (*Rhizophora stylosa*) and large-leafed mangrove (*Bruguiera gymnorhiza*).

Like seagrasses, mangroves have been widely recognised as important ecological communities, and some studies suggest they are the most productive (in terms of organic matter produced per hectare per year) of all estuarine habitats (Larkum, 1981). They: provide habitat for a variety of fish and invertebrates (e.g. SPCC, 1981a,b; Pollard and Hannan, 1994; Robertson and Alongi, 1995); provide organic materials that form the basis of detrital food chains (West, 1985; Robertson and Alongi, 1995); provide feeding and roosting habitat for numerous species of birds (Chapman and Underwood, 1995); stabilise sediments (West, 1985; Robertson and Alongi, 1995); recycle nutrients (Robertson and Alongi, 1995); and act as a filter system between the land and aquatic environment (NSW Fisheries, 1999a). Many commercially important marine and estuarine species live in mangrove channels as small juveniles including yellowfin bream, luderick, dusky flathead, silver biddy, sea mullet, flat-tail mullet, prawns and mud crabs. They also feed and shelter in mangrove channels as adults, as do several non-commercial species (Bell *et al.*, 1984). As mangroves are partially drained at low tide, there are few resident fishes of mangroves, rather they are visited during high tide by species from adjacent habitats (Hutchings and Recher, 1974; Rooker and Dennis, 1991). Resident species are likely to include gobies, perchlets and toadfish.

Mangroves are not as widespread as seagrasses because of their reliance upon more marine conditions. As such, they are rarely recorded from estuaries that are intermittently open to the sea, which comprise about 50% of all estuaries. Further, three estuaries, Port Stephens (25%), Hunter River (15%) and Hawkesbury River (10%) account for 50% of the total area of mangroves recorded in NSW. These are all located in the central region of the State, are large in terms of surface area and are permanently open to the sea.

## 3. Saltmarsh

Saltmarsh refers to a collection of herbaceous plants and low shrubs that can tolerate highly saline soils and at least occasional inundation by seawater (King, 1981b; Morrissey, 1995). Generally, they are found on the high shore between average high water of spring and neap tides and consequently often remain covered by water for long periods (Morrissey, 1995). They develop on shorelines in estuaries with soft sediments and along sheltered parts of the coast, usually behind



sandbars and in bays. As such, they are less common in the relatively steep-sided drowned river valleys and more common in barrier and coastal lagoons. Saltmarshes are relatively flat, with shallow pools separated by mounds that are usually vegetated. The plants that make up saltmarshes belong to a small number of families, most notably the grasses (Poaceae), saltbushes (Chenopodiaceae), rushes (Juncaceae) and sedges (Cyperaceae), and although more than 200 species have been recorded in Australia, most assemblages contain only a few species (Morrisey, 1995). Further, the species are generally divided into distinct zones across the marsh, or up the shore. In NSW, the lower shores are dominated by samphire (*Sarcocornia quinqueflora*), with saltwater couch (*Sporobolus virginicus*) on the slightly higher ground. Rushes (particularly *Juncus kraussii*) are also often prominent, especially near landward margins. Other common species include streaked arrow-grass (*Triglochin striata*), seablite (*Suaeda australis*) and *Samolus repens*.

There has been little work done in Australia on the value of saltmarsh as fish habitat, and extrapolations from studies in the Northern Hemisphere are not possible because they relate to fundamentally different marshes. Not only is the species composition different, but the plants are much taller than their analogues in NSW (Adam *et al.*, 1988). Overall, saltmarshes are thought to play a similar water filtration role to that outlined for mangroves (Adam *et al.*, 1985). They are also commonly regarded as highly productive (Zann, 1996), although specific information on details such as energy pathways, and the export of detritus to adjacent habitats, is very limited and invariably from overseas studies in different types of saltmarsh to those in NSW (Morrisey, 1995; Adam *et al.*, 1985).

Due to their perceived high productivity, it is probable that the major role of saltmarshes as far as fish and invertebrates are concerned is in the export of organic material to estuarine and marine environments. Numerous overseas studies have reported the importance of saltmarsh creeks as juvenile fish habitat, but as stated previously these marshes are very different to those in NSW, which do not have major contiguous creeks flowing through them (Adam *et al.*, 1985).

Williams *et al.* (1995) studied saltmarsh fish communities as part of a major study of habitat rehabilitation in the lower Hunter River. The most common commercial species were flat-tail mullet and yellowfin bream. Individuals of these two species were mainly juveniles, but also included some adults. The non-commercial species included gobies, perchlets and sprats. Morton *et al.* (1987) sampled fish in a tidal inlet to a saltmarsh in southern Moreton Bay, Queensland. Nineteen species of fish were recorded, 11 of which were of economic importance. Banded toadfish were the most common species (~ 27%), followed by flat-tail mullet (~ 25%) and yellowfin bream (~ 16%).

Saltmarshes provide important habitat for birds, crabs, molluscs and insects (Morrisey, 1995). Saltmarshes are used by a large variety of migratory and resident birds for feeding, roosting and/or breeding, including egrets, sandpipers, curlews, whimbrels, plovers, dotterels and banded stilts (Morrisey, 1995; Zann, 1995, 1996). They also provide habitat for some terrestrial species, such as chats and parrots, and several birds of prey, such as brahmyn kites, whistling kites and harriers.

Saltmarsh is widely distributed and occurs within estuaries along the entire NSW coastline. In 1985, the total area occupied by saltmarsh within NSW was approximately 57 km<sup>2</sup> (West *et al.*, 1985) and, as with the other estuarine habitats, only a few estuaries account for more than 50% of the total cover. Port Stephens has the largest area of saltmarsh, 7.7 km<sup>2</sup>, and when added to Karuah River (an arm of Port Stephens) with 4.8 km<sup>2</sup>, they account for 25%. Lake Innes/Cathie (12%), Hunter River (10%) and Wallis Lake (8%) also have extensive areas of saltmarsh. Like seagrass and to an even greater degree, anthropogenic processes have affected many areas of saltmarsh. Those near urban centres are degraded because of weed infestations, dumping, stormwater runoff and damage from off-

road vehicles (Adam *et al.*, 1988; Zann, 1995, 1996). Significant losses have occurred as a result of reclamation and drainage and it is suggested that along the Central Coast, more than half of the original saltmarsh area may have been lost (Adam *et al.*, 1988; Zann, 1995, 1996). In some cases, local destruction or modification of saltmarsh will have occurred where foreshore works, such as floodgates, culverts and levee banks, impede tidal exchange (Williams and Watford, 1996).

## 4. Unvegetated Soft Substrata

Unvegetated soft substrata, including shallow mudflats, sandflats and deeper areas, are the most common habitat in estuaries, yet are largely ignored because of their lack of physical structure. Their type and distribution have not been recorded in previous estuarine inventories, rather mapping vegetated areas (West *et al.*, 1985; Bell and Edwards, 1980) has implied their extent. Such mapping, however, does not discriminate between sandy and muddy areas, which support different assemblages of invertebrates, and therefore probably different fishes and birds.

In comparison to vegetated habitats such as seagrass and mangroves, intertidal shores have not been studied much in Australia (Inglis, 1995), possibly because of their lack of habitat complexity and readily identifiable features. Intertidal shores can comprise both sandflats and mudflats, the major difference being the relative proportions of sand, silt, clay and organic matter in the sediment. Sandflats are generally found near the mouths of estuaries, where there are stronger currents and wave action, and sand. Mudflats are located further upstream in more sheltered environments, where silt and clay that has been carried downstream from the upper catchment settles out in response to a reduction in flow and mixing with more saline waters (NSW DPWS, 1992). Mudflats remain saturated during low tide due to their smaller particle size and chemical properties prohibiting the creation of large spaces between particles (Inglis, 1995). This also causes minimal flushing with oceanic water, and combined with the decomposition of organic matter, causes all but the top few centimetres of sediment to become deoxygenated (Inglis, 1995). As most animals can not survive anoxic conditions, mudflats are comprised of a distinct set of fauna, which is discussed in detail below.

Most of the studies of assemblages of fish associated with unvegetated sediments have been done in comparison to vegetated habitats such as seagrass (e.g. SPCC, 1981a; Ferrell and Bell, 1991; Connolly, 1994; Gray *et al.*, 1996). Such studies generally found that seagrasses supported more diverse and abundant assemblages, but that bare sand was also important for some species, particularly sand whiting, sand mullet, silver biddy, snapper, flatheads and flounders (SPCC, 1981a; Gray *et al.*, 1990; Ferrell and Sumpton, 1997). Bare substrata are also important habitat for many species of baitfish, particularly sprats and sardines (Clupeidae), hardyheads (Atherinidae) and anchovies (Engraulidae) (Lincoln Smith and Jones, 1995). SPCC (1981a) recorded 102 species from soft bare substrata within Botany Bay and, in relation to other habitat types within the bay, concluded that many species of marine and estuarine fishes inhabit soft bare substrata during at least part of their life cycle. Whilst not generally recognised as nursery habitat to the same extent as are vegetative habitats such as seagrass, bare substrata, particularly that adjacent to seagrasses, provides further habitat complexity within an estuary and important habitat for the adults of many species.

In addition to fishes, soft substrates are inhabited by a large variety (often hundreds of species) of invertebrates including polychaete worms, crustaceans and molluscs collectively termed benthos (Rainer, 1982; Jones *et al.*, 1986; Morrissey *et al.*, 1992a,b; CSIRO, 1994). Depth, salinity, sediment size characteristics and the degree of sediment movement are among the physical factors that determine benthic community composition (Jones and Candy, 1981; CSIRO, 1994; Zann, 1996).

Irrespective of specific assemblage composition, benthos can be broadly classified according to their method of feeding (Morrissey, 1995). Suspension-feeders trap suspended organic material, microbes and small animals from the water above the sediment. Deposit-feeders obtain food by swallowing the sediment itself. Browsers move over the surface of the sediment consuming organic matter. Predators often live in tubes or burrows waiting for their prey to pass by, or roam the surface of the sediment in search of prey (e.g. crabs and prawns). Scavengers are the final group and consists largely of gastropod molluscs feeding on decaying animal matter. Any or all benthos can be subsequently eaten by many species of fish (SPCC, 1981b). Sand whiting and silver biddy feed on polychaete worms and small crustaceans, whilst yellowfin bream eat worms, molluscs and larger crustaceans.

Bare substrata are no less prone to modification than other habitats. Human impacts are particularly evident in those estuaries supporting major port facilities and/or having extensive industrial/residential development in their catchments; e.g. Newcastle Harbour, Port Jackson and Botany Bay. Large areas within these estuaries have been made deeper and muddier as a result of dredging (e.g. Jones and Candy, 1981; Birch *et al.*, 1997), and are contaminated by nutrients, heavy metals and toxic chemicals (Shotter *et al.*, 1995; Birch, 1996; Birch *et al.*, 1996, 1997; Irvine and Birch, in press). With respect to benthic invertebrates, these impacts are likely to have resulted in reduced diversity (e.g. Jones and Candy, 1981) and shifts in community composition (Jones, 1997).

As stated previously, bare substrata have not been included in estuarine inventories done in the past in NSW (e.g. Bell and Edwards, 1980; Bucher and Saenger, 1991; West *et al.*, 1985). The distribution of the major intertidal shores, however, has been inferred by a mapping program by the EPA (formerly the SPCC). The EPA mapped the distribution of coastal resources that could be affected by oil spills, and used records of occurrence of wading and threatened birds from the NPWS database and waterway maps to map their occurrence within estuaries (S. Carter, NSW Fisheries, pers. comm.). Most such areas are found in the lower parts of estuaries where sandflats are utilised, and in the upper parts where mudflats dominate.

## **5. Rocky Shores and Reefs**

The other key habitat within estuaries is that of intertidal rocky shores and subtidal rocky reefs, although they are far less common than the other habitats. Rocky shores include both natural reef and man-made habitats such as breakwaters (SPCC, 1981a; Pollard, 1989). Natural rocky shores are most common in the drowned river valleys such as Port Jackson, Hawkesbury River and Port Hacking (Morrissey, 1995), and artificial rocky shores are common at the mouths of many barrier estuaries, such as Clarence River and Wallis Lake. The areas of rocky shorelines and reefs have not been mapped in previous inventories.

There are no studies of overall distribution or physical or biological composition within NSW estuaries. It is likely that many estuarine reefs, being subject to freshwater influence, are relatively species-poor, providing interim habitat for larger juvenile fish moving between nursery habitats (such as seagrass and mangroves) and habitats used by adults (SPCC, 1981b).

Many species of fish and invertebrates depend on rocky reef habitat for some or all of their life (e.g. SPCC, 1981b; Hamer, 1986). Species of economic importance include rock blackfish, red morwong, luderick, bream, octopus, eastern rock lobster and abalone. Also, many of the protected aquatic species in NSW depend on rocky reef habitat for part, if not most of their life cycle, including grey nurse shark, blue devil fish, elegant wrasse, black and estuarine cod, blue groper, Australian bass and estuary perch (NSW Fisheries, 1999a).

Diverse assemblages of brown, red and green macroalgae, along with sponges, ascidians and other sessile invertebrates enhance habitat complexity of rocky shores and reefs and provide many opportunities for specialisation (e.g. Jones and Andrew, 1990; Lincoln Smith and Jones, 1995). The large macroalgae (such as kelp) that partially cover most rocky reefs enhance overall species diversity by providing patches of shaded habitat favoured by distinct assemblages of organisms (Kennelly, 1995b). Also, rocky reefs along most of the NSW coast, including those within estuaries, are utilised on a seasonal basis by juveniles of tropical species. These juveniles are swept southward by the East Australian Current each summer and autumn (Kailola *et al.*, 1993; Kuitert, 1993), but do not usually survive the winter or, if they do, they fail to establish breeding populations (Lincoln Smith and Jones, 1995). Rocky reef provides refuge and feeding opportunities for a variety of fish and mobile invertebrates (e.g. SPCC, 1981b; Jones and Andrew, 1990; Lincoln Smith *et al.*, 1992; Lincoln Smith and Jones, 1995). Small fish and invertebrates can escape predators by hiding in cracks and crevices and larger fish such as yellowfin bream, sergeant baker, wirrah and red rock cod, along with octopus and cuttlefish appear to use rocky reef as cover from which they can ambush passing prey. Pelagic fish including kingfish, tailor and Australian salmon are also attracted to rocky reef areas by aggregations of small baitfish such as yellowtail. Some fish, such as luderick, herring cale, surgeon fishes and drummers along with abalone and sea urchins eat drift and/or attached algae associated with rocky reefs (e.g. Hamer, 1986; Jones and Andrew, 1990).

It is apparent that there are numerous aquatic habitats within estuaries, and that they all serve different and important functions for fish and invertebrates targeted in the Estuary Prawn Trawl Fishery. Rather than attempt to prioritise habitats in terms of importance however, it is more important to realise that they are interconnected. Loss of one habitat type or area is unlikely to be compensated for by the existence of an adjacent habitat. Studies suggest that in terms of habitat for juvenile fish and invertebrates, seagrass is the most important habitat, but if adjacent mangroves and saltmarsh are lost, then there is likely to be a drop in productivity and an increase in sediments and nutrients entering the system. These inputs could diminish the value of seagrass habitat or ultimately lead to its disappearance, with the resultant change in faunal composition.



## APPENDIX F3. JAMBA AND CAMBA BIRDS

**Table AF1.** JAMBA and CAMBA birds that could be affected by the Estuary Prawn Trawl Fishery.

| Family         | Common Name              | Species Name                     |     | Season when in NSW estuaries | Breeding |
|----------------|--------------------------|----------------------------------|-----|------------------------------|----------|
| Procellariidae | Streaked Shearwater      | <i>Calonectris leucomelas</i>    | J,C | Su                           | no       |
|                | Wedge-tailed Shearwater  | <i>Puffinus pacificus</i>        | J   | Sp & Su                      | yes      |
|                | Fleshy-footed Shearwater | <i>Puffinus carneipes</i>        | J   | Su & Au                      | no       |
|                | Sooty Shearwater         | <i>Puffinus griseus</i>          | J,C | Sp, Su & Au                  | no       |
|                | Short-tailed Shearwater  | <i>Puffinus tenuirostris</i>     | J   | Sp, Su & Au                  | no       |
| Ardeidae       | Cattle Egret             | <i>Bubulcus ibis</i>             | J,C | Winter                       | no       |
|                | White Egret              | <i>Egretta alba</i>              | J,C | All                          | yes      |
|                | Eastern Reef Egret       | <i>Egretta sacra</i>             | C   | All                          | no       |
| Scolopacidae   | Turnstone                | <i>Arenaria interpres</i>        | J,C | Sp & Su                      | no       |
|                | Eastern Curlew           | <i>Numenius madagascariensis</i> | J   | Sp, Su & Au                  | no       |
|                | Whimbrel                 | <i>Numenius phaeopus</i>         | J,C | Sp & Su                      | no       |
|                | Little Whimbrel          | <i>Numenius minutus</i>          | J,C | Sp & Su                      | no       |
|                | Little Greenshank        | <i>Tringa stagnatilis</i>        | J,C | Winter                       | no       |
|                | Greenshank               | <i>Tringa nebularia</i>          | J,C | Sp & Su                      | no       |
|                | Wood Sandpiper           | <i>Tringa glareola</i>           | J,C | Sp & Su                      | no       |
|                | Grey-tailed Tattler      | <i>Tringa brevipes</i>           | J,C | Sp & Su                      | no       |
|                | Wandering Tattler        | <i>Tringa incana</i>             | J,C | Sp & Su                      | no       |
|                | Common Sandpiper         | <i>Tringa hypoleucos</i>         | J,C | Sp, Su & Au                  | no       |
|                | Terek Sandpiper          | <i>Xenus cinereus</i>            | J,C | Sp & Su                      | no       |
|                | Japanese Snipe           | <i>Gallinago hardwickii</i>      | J,C | Sp & Su                      | no       |
|                | Black-tailed Godwit      | <i>Limosa limosa</i>             | J,C | Sp & Su                      | no       |
|                | Bar-tailed Godwit        | <i>Limosa lapponica</i>          | J,C | Sp & Su                      | no       |
|                | Red-necked Stint         | <i>Calidris ruficollis</i>       | J,C | Aug-May                      | no       |
|                | Long-toed Stint          | <i>Calidris minutilla</i>        | J,C | Sp & Su                      | no       |
|                | Sharp-tailed Sandpiper   | <i>Calidris acuminata</i>        | J,C | Aug-Apr                      | no       |
|                | Curlew Sandpiper         | <i>Calidris ferruginea</i>       | J,C | Sp & Su                      | no       |
|                | Knot                     | <i>Calidris canutus</i>          | J,C | Aug-Apr                      | no       |
|                | Great Knot               | <i>Calidris tenuirostris</i>     | J,C | Sp & Su                      | no       |
|                | Sanderling               | <i>Crocethia alba</i>            | J,C | Sp & Su                      | no       |
|                | Broad-billed Sandpiper   | <i>Limicola falcinellus</i>      | J,C | Sp & Su                      | no       |
|                | Ruff                     | <i>Philomachus pugnax</i>        | J,C | Sp & Su                      | no       |
| Rostratulidae  | Painted Snipe            | <i>Rostratula benghalensis</i>   | C   | All                          | yes      |
| Charadriidae   | Mongolian Sand-Plover    | <i>Charadrius mongolus</i>       | J,C | Sp & Su                      | no       |
|                | Large Sand-Plover        | <i>Charadrius leschenaultii</i>  | J,C | Aug-May                      | no       |
|                | Eastern Golden Plover    | <i>Pluvialis dominica</i>        | J,C | Aug-Apr                      | no       |
|                | Grey Plover              | <i>Pluvialis squatarola</i>      | J,C | Aug-Apr                      | no       |
| Stercorariidae | Pomarine Skua            | <i>Stercorarius pomarinus</i>    | J,C | Sp & Su                      | no       |
|                | Arctic Skua              | <i>Stercorarius parasiticus</i>  | J   | Sp & Su                      | no       |
| Laridae        | White-winged Black-tern  | <i>Chlidonias leucoptera</i>     | J,C | Sp & Su                      | no       |
|                | Crested Tern             | <i>Sterna bergii</i>             | J   | All                          | yes      |
|                | Asiatic Common Tern      | <i>Sterna hirundo</i>            | J,C | Sp & Su                      | no       |
|                | Little Tern              | <i>Sterna albifrons</i>          | J,C | Sp & Su                      | yes*     |
|                | Caspian Tern             | <i>Sterna caspia</i>             | C   | All                          | yes      |
| Accipitridae   | White-bellied Sea-Eagle  | <i>Haliaeetus leucogaster</i>    | C   | All                          | yes      |

(Source: Simpson and Day, 1996; Pizzey and Doyle, 1984; NPWS Atlas of Wildlife database)

\* denotes that little terns have historically bred in approximately 70 estuaries, but the numbers of successful sites is diminishing. The most successful sites at the time of this report were Harrington, Farquhar Inlet, Sawtell, Botany Bay and Lake Wollumboola.

J=JAMBA and C= CAMBA



## APPENDIX F4. PROFILES OF THREATENED SPECIES

### 1. Fisheries Management Act 1994

#### a) Endangered species

##### Green sawfish (*Pristis zijsron*)

The following information was taken from the NSW Fisheries Scientific Committee's website ([www.fsc.nsw.gov.au](http://www.fsc.nsw.gov.au)), which provides profiles of species listed in the FM Act. Green sawfish have been recorded in the tropical Indo-West Pacific from eastern Australia and Papua New Guinea through to western India, with a disjunct population off Mozambique and eastern South Africa. In Australia, the species occurs mainly in the tropics from Broome to southern Queensland, with individuals found as far south as Sydney and a single record from Glenelg, South Australia. In NSW, specimens have been collected from Byron Bay in the north to Parramatta River in the south, plus an unofficial record from Jervis Bay. The species is thought to grow to approximately 7.3 m in length and has been reliably recorded at 5 m, with males maturing by 4.3 m. This is a species with low fecundity and it is thought that they may have up to 20 young. They feed on fishes and benthic invertebrates, using the saw as a club to stun schooling fishes such as mullet, and as a shovel to uncover benthic animals (Allen, 1989). Green sawfish have suffered a serious population decline in NSW. Prior to 1972, the species was regularly found in the shallow waters at the mouths of the Tweed, Clarence and Richmond Rivers and on outside ocean beaches such as Yamba. The last specimen from the Sydney region was taken in 1926. The causes of this decline are thought likely to include:

- bycatch in shallow water prawn trawling, and other netting methods in shallow water, as they would rarely have been returned to the water alive
- targeted harvest for flesh, fins and saws. The fins command a high price in the shark fin trade and the saws are used in traditional medicine and were sold as curios
- habitat degradation.

Sawfish are also listed as vulnerable under the EPBC Act 1999.

##### Grey nurse shark (*Carcharias taurus*)

Grey nurse sharks are found around the world in inshore waters, primarily in sub-tropical and temperate regions around the main continental landmasses, with the exception of the eastern coast of North and South America and Antarctica. Known key sites for grey nurse sharks or major aggregations of the species in NSW can be found at reefs off Port Stephens, Seal Rocks, Forster, Laurieton, Batemans Bay and South West Rocks. Relatively little is known about the migratory habits of Australian grey nurse sharks. There is evidence from Australian data that suggests migrational movement, probably in response to water temperatures, up and down the coast. At certain times of the year, grey nurse sharks aggregate according to sex. Males are predominant in southern Queensland during July to October, while a high proportion of sharks off central NSW at the same time of year is composed of females. Grey nurse sharks are often observed just above the seabed in or near deep sandy-bottomed gutters or rocky caves, in the vicinity of inshore rocky reefs and islands, generally between 15 m and 25 m. They have also been recorded in the surf zone, around coral reefs, and to



depths of around 200 metres on the continental shelf. The diet of the adult grey nurse shark consists of a wide range of fish, other sharks, squids, crabs and lobsters, and some observations also suggest that schools of grey nurse sharks can feed cooperatively by concentrating schooling prey before feeding on them (Environment Australia 2000a).

In Australia, two populations are thought to exist, one on the east coast and one on the west. The east coast population has been recorded from as far north as Mackay and extends south around the greater part of the southern half of the continent. On the west coast, the population extends as far north as the North West Shelf. They are still found within this general historical range, but the east coast population is thought to have declined considerably. During the 1960s and 1970s, spearfishers took large numbers of grey nurse sharks and reduced the population to a low level. Setlining by commercial fishers also continues to take a small number each year, and the beach meshing program was also responsible for catching large numbers of grey nurse sharks up until 1975. Despite protection since 1984 in NSW waters, the species has not shown an increase in population size. Current research (quarterly surveys from November 1998) indicates a much lower adult population size than when the species was recommended to be listed as a vulnerable species in NSW (early 1999), and the status of juvenile numbers in the sampled population is uncertain (www.fsc.nsw.gov.au, 1999). These factors were also largely responsible for its listing as a vulnerable species under the EPBC Act.

## **b) Vulnerable species**

### Black cod (*Epinephelus daemeli*)

Black cod are found on estuarine and inshore reefs and deeper offshore reefs in temperate and subtropical waters of the southeastern Pacific. In Australia, they are found from Queensland to Kangaroo Island, although they are rare and probably only represented by non-breeding migrants in more southern areas. Hence, they are found along the entire NSW coastline, which is also the centre of the species' Australian mainland distribution (Heemstra and Randall, 1993; Pogonoski *et al.*, In prep). Their maximum size is 1 - 2 metres in length, but are commonly only found up to 0.8 m (Hutchins and Swainston, 1986). Smaller fish are females, which change sex to become male at around 1 m in length (Pollard, unpublished). They are an aggressive, highly territorial species, and are usually found in association with caves, ledges or large underwater structures such as bridge pylons that they may occupy for life (Gill and Reader, 1992; Henrisson and Smith, 1994). Their numbers are reported to have declined significantly as a result of spearfishing pressure in the 1970s (Pogonoski *et al.*, In prep.). Lincoln Smith *et al.* (1989) reported that 137 black cod were caught in spearfishing competitions in NSW in 1976 alone. Their territorial and curious nature, combined with their slow movement, is thought to have made them an easy target and a prize catch by both line and spearfishers, although they are no longer thought to be targeted by either group of fishers. Commercial fishers still report occasional captures, particularly from deeper offshore reefs. Historical, anecdotal evidence suggests that a decline in abundance in the Sydney region occurred around 1900 when coastal towns became populous and fishing and shipping pressures increased (Roughley, 1951). Their slow growth and territoriality probably also prevents rapid recovery from decreases in population. Despite protection in NSW waters since 1983, there is no evidence of an increase in their abundance.

### Great white shark (*Carcharodon carcharias*)

White sharks are found worldwide in temperate, coastal waters but are rare in tropical waters. In Australia, they have been recorded from southern Queensland to northwestern Western Australia. There are no reliable estimates of the number of white sharks in Australian waters, but it is thought that the numbers of fish are decreasing. Based on data sets from the region between Port Stephens and

Wollongong, great whites appear to have suffered a population decline in NSW, with a reported decreases in annual catches in beach meshing from 1950s to 1990s, and less compelling evidence of decline from game-fishing landings (www.fsc.nsw.gov.au, 1998).

In many places around the world the white shark is a protected species (Environment Australia, 2000b). This happened first in South Africa in 1992, then in Namibia, the Maldives, and in Florida and California. This species is now protected in all Australian State and territorial waters. It is believed that a white shark of 5 – 6 m in length is likely to be 15 - 25 years old, and the most commonly encountered white sharks are between 3 - 4 m in length. Females mature at 4.5 - 5 m in length and males at probably less than 4 m, and as the fish matures, its diet changes. Fishes to about 2 metres normally eat squid and other fishes such as stingrays and other sharks. Adults eat seals, sea lions, dolphins and dead whales, although some will continue to eat fishes such as snapper. They have also been known to eat elephant seals, sea otters, turtles and sea birds. Great whites are also listed as vulnerable under the EPBC Act 1999.

### **c) Protected species - Section 19 (totally protected)**

#### Australian grayling (*Prototroctes maraena*)

Australian grayling are essentially a freshwater fish that inhabits coastal streams in southeastern Australia, including Tasmania. It is the only extant species in the family Prototroctidae, as the New Zealand grayling (*P. oxyrhynchus*) is presumed extinct. Australian grayling grow to about 300 mm or about six years, but are more common at around 250 mm. They form aggregations and spawn in freshwater between mid-May and mid-July, and many are thought to die shortly after spawning, at about 2 - 3 years of age. The larvae are apparently swept downstream to the estuary or the sea, and sub-adult fish, 55 - 75 mm in length, return to freshwater habitats six months later (Faragher, 1995). In the past, anglers often caught them during spawning aggregations, but they are now totally protected. Their diet includes small crustaceans, insects and their larvae and algae. Australian grayling appear to undergo long-term fluctuations in population abundance, with spawning success and larval survival governed by highly variable flows and unobstructed passage to the sea. These requirements are thought to have restricted their distribution to several river catchments on the far south coast of NSW (Faragher, 1995). It is also listed as vulnerable under the EPBC Act 1999.

#### Eastern blue devil (*Paraplesiops bleekeri*)

Eastern blue devils are recorded from coastal waters of southern Queensland to southern NSW, and seem common only south of Sydney to Ulladulla (Kuiter, 1993). They grow to 40 cm in length and inhabit rocky reefs in both estuaries and offshore, from 3 - 30 m in depth. Eastern blue devils are totally protected.

#### Elegant wrasse (*Anampses elegans*)

Elegant wrasse are recorded from the southwestern Pacific, generally from central to southern NSW, Lord Howe Island, Easter Island and northern New Zealand. Juveniles are found in weeds in coastal bays and harbours, larger juveniles in small aggregations on coastal and estuarine rocky reefs and adults usually deeper to about 30 m (Kuiter, 1993). They feed on a variety of invertebrates and algae. Females often occur in aggregations of up to 80 or more fish, in contrast to the singular, territorial males, and grow to about 30 cm. Elegant wrasses are totally protected.

#### Estuary cod (*Epinephelus coioides*)

Estuary cod are found on estuarine and inshore reefs along the NSW coastline from about Sydney northwards (Heemstra and Randall, 1993; Pogonoski *et al.*, In prep.). They are reasonably

territorial, but have been found in a wide variety of estuarine and marine habitats: within NSW estuaries, they are most likely to occur around drop-offs or in caves (Pogonoski *et al.*, In prep.). Estuary cod grow to about 1 metre in length (Kuitert, 1993), and although they were probably never abundant in NSW estuaries, are considered vulnerable to a variety of fishing pressures including demand for the live fish trade (Pogonoski *et al.*, In prep.). Consequently, they are totally protected in NSW waters.

#### Queensland groper (*Epinephelus lanceolatus*)

The Queensland groper is fairly similar to the estuary cod, and has a similar range and habitat preference within NSW (Pogonoski *et al.*, In prep.). They do, however, grow to a much larger size of up to 3 metres (Kuitert, 1993). Queensland groper is totally protected within NSW waters for similar reasons to those applicable to the estuary cod.

#### Weedy seadragon (*Phyllopteryx taeniolatus*)

Seadragons are a member of the family Syngnathidae, which also includes seahorses and pipefishes. An unusual feature of this family of small fishes is that the male broods the young, which leave the brood pouch at a relatively advanced stage (Kuitert, 1993). Weedy seadragons are found on estuarine and inshore reefs along the NSW coastline north to about Port Stephens (Hutchins and Swainston, 1986). Their preferred habitat appears to be the interface between kelp beds and sand (Kuitert, 1993). Their maximum size is about 45 cm (Kuitert, 1993). The species is quite common in its preferred habitat and population numbers are not thought to have declined (Pogonoski *et al.*, In prep.), however, due to its vulnerability to over-collecting for the aquarium trade, it is totally protected within NSW waters.

### **d) Protected species - Section 20 (protected from commercial fishing)**

#### Australian bass (*Macquaria novemaculeata*)

Australian bass are primarily a freshwater fish, found in coastal rivers, lakes and estuaries along the entire NSW coastline (Pollard and Growns, 1993). They occur from as far north as Fraser Island off Queensland, to Wilsons Promontory in Victoria. Adults migrate downstream to breed in estuaries during winter, with spawning success and subsequent recruitment linked to flooding (Harris, 1986). They feed on prawns, fishes, molluscs and insects. Australian bass are a prized sportfish among anglers and are protected from commercial exploitation in NSW. Populations have declined in the face of previous harvesting of spawning aggregations, river regulation (affecting both fish passage and the frequency of flooding), and catchment alteration (Harris, 1984; Pollard and Growns, 1993).

#### Blue groper (*Achoerodus viridis*)

The blue groper is a marine fish that inhabit inshore rocky reefs along the entire NSW coastline (Kuitert, 1993). Their young recruit to sheltered habitats that provide physical structure, including estuarine seagrass beds (Gillanders, 1999). Larger juveniles are common around sheltered rocky reefs within the lower reaches of marine-dominated estuaries, and appear to gradually move out to inshore reefs as they grow (Gillanders, 1999). They are a popular angling species, attaining at least 1.2 metres in length (Kuitert, 1993). Populations appeared to decline sharply in the 1960s because of fishing pressure, and although significant recovery has occurred in recent years, the species remains protected from spearfishing and commercial exploitation within NSW in view of its curious behaviour and popularity with SCUBA divers (Smith *et al.*, 1996).

#### Estuary perch (*Macquaria colonorum*)

The estuary perch has a similar distribution and biology to that of the Australian bass but it prefers slightly more saline waters, and is therefore more likely to be found in upper estuarine/brackish water rather than freshwater areas (Merrick and Schmida, 1984). Spawning occurs in saltwater areas of estuaries when temperatures reach 14.5 - 16°C. Each female releases several hundred thousand eggs that float to the surface, where hatching occurs 2 - 3 days later. The diet of larger fish consists of prawns, worms, bivalve molluscs and fishes (Allen, 1989). In view of its similarity to the bass, the estuary perch is subject to the same bag and size limits, and is also protected from commercial exploitation in NSW.

## 2. Threatened Species Conservation Act 1995

Unless otherwise specifically referenced, the following species profiles were obtained from the website of the NSW National Parks and Wildlife Service, at [www.npws.nsw.gov.au/2001](http://www.npws.nsw.gov.au/2001). The profiles for marine turtles and dolphins were obtained from the website of Environment Australia, at [www.environment.gov.au](http://www.environment.gov.au), respectively.

### a) Endangered species

#### *Birds*

##### Beach stone-curlew (*Esacus magnirostris*)

Beach stone-curlews are exclusively coastal and have been recorded around the north coast of Australia and associated islands from Onslow in Western Australia to the Nambucca River in NSW, and rarely southwards to Forster (Marchant and Higgins, 1993). They have largely disappeared from the southeastern part of its former range and are now rarely recorded on ocean beaches in NSW. They prefer open, undisturbed beaches, islands, reefs and estuarine intertidal sandflats and mudflats with mangroves nearby. They also frequent river mouths, offshore sandbars associated with coral atolls, reefs and rock platforms and coastal lagoons. They forage at low tide in search of crabs and other marine invertebrates. Threats to the species include loss of habitat due to residential and industrial development, human disturbance through beach-combing, boating and 4WD vehicles, predation by raptors, cats and dogs, nest destruction by pigs or high tides, and nest desertion.

##### Bush stone-curlew (*Burhinus grallarius*)

Bush stone-curlews are widespread in the north and northeast of Australia (Marchant and Higgins, 1993). This species has largely disappeared from the southern part of its former range, probably because of extensive clearing of woodlands. Records indicate that the species was once common throughout eastern NSW, but it is now restricted to populations at Gosford, Port Macquarie, Grafton, Port Stephens and Karuah. They prefer lightly timbered open forest and woodlands, particularly of casuarina, eucalyptus, acacia or polycarpa. They are occasionally recorded in mangroves and saltmarsh, especially when bordered by casuarinas, and have been recorded nesting within saltmarsh (Marchant and Higgins, 1993). They feed on insects, molluscs, centipedes, crustaceans, spiders, frogs, lizards, snakes and some vegetation and seeds (Marchant and Higgins, 1993). Threats to the species include loss of habitat due to residential and industrial development, intense cultivation, small subdivision, overgrazing and burning (Marchant and Higgins, 1993).

##### Little tern (*Sterna albifrons*)

Little terns are migratory or partly migratory seabirds. They occur from Shark Bay in Western Australia, around northern and eastern Australia, to the east coast of Tasmania and around to the Gulf

of St Vincent in South Australia. In NSW, a second population of the subspecies *sinensis* predominantly occurs, which is migratory, breeding in the spring and summer along the entire east coast from Tasmania to northern Queensland. The other population of the subspecies breeds in Asia and migrates to Australia in summer, masking the size of the threatened, eastern Australian population. Little terns have been recorded nesting at 70 sites along the NSW coast, but this has declined to only 31 since 1987 and 11 in 1998/99. Since 1995, the largest, most successful colonies have been at Sawtell, Harrington, Botany Bay, Lake Wollumboola and more recently Farquhar Inlet (formerly known as Old Bar) (NPWS, 2000a). In NSW, the species is strictly coastal. Most of the nesting sites are sand-spits, sand islands or beaches within or adjacent to the estuaries of rivers, creeks and coastal lakes. Nesting also occurs at some sites on ocean beaches well away from estuaries, but often with a large coastal lake nearby. Little terns in NSW feed predominantly, perhaps exclusively, on fish less than 10 cm long and are often generally referred to as whitebait. They include perchlets (*Ambassis* spp.), surfsardines (*Iso rhothophilus*) and sprats (Clupeidae), but may also include juvenile mullet, gudgeons, tailor and whiting. Most feeding occurs inside or at the mouths of estuaries and up to 500 m offshore. There are numerous threats to the species, and human disturbance has been identified as a major, and often the most important factor leading to poor breeding success and abandonment of nest sites. Human disturbance can range from the extreme of 4WD and trail-bike use through to walking or simply sitting or fishing on the beach, all of which may keep the terns off nests. Others include adverse weather conditions, nesting at locations prone to flooding, predation by foxes, dogs, cats, rats and a variety of birds, coastal development, availability of food, damage to estuarine habitats and pollution (NPWS 2000a). It is also listed as endangered under the EPBC Act 1999.

### ***Plants***

#### **Zannichellia palustris**

*Zannichellia palustris* is a submerged, weakly rhizomatous aquatic annual or perennial plant. It has a cosmopolitan distribution, but in Australia is known only from the Murray River estuary in South Australia and the lower Hunter region in NSW. It is considered to be indigenous to NSW and is recognised as rare nationally. It occurs in fresh to brackish, still to slowly moving waters, and recent collections of *Zannichellia palustris* in NSW are from Ironbark Creek and tributaries at Shortland and Wallsend, in Black Creek at Cessnock and in ponds on Kooragang Island. It has also been recorded from near Belmont. NSW populations of *Zannichellia palustris* behave as annuals and dieback completely each summer. The individual patches range from about 5 m<sup>2</sup> to 100 m<sup>2</sup>, but vary from year to year. None of the known sites of *Zannichellia palustris* in NSW are formally protected, and none are managed in any way for the conservation of the species. Further, all the known sites are in areas where considerable changes have, and are continuing, to take place in their catchments. These changes in catchment land use may result in changes in hydrological conditions and water quality, which may affect the ability of the species to persist in areas where it is known to occur.

## **b) Endangered populations**

#### **Little penguins (*Eudyptula minor*) at Manly, Sydney Harbour**

Little penguins, only found in Australia and New Zealand, once ranged from Swan River in Western Australia through Tasmania and up to Moreton Bay in Queensland, and may still occasionally venture that far. They are relatively common in the waters of southern Australia, breeding mainly on offshore islands. They generally breed from south of Port Stephens in NSW, including the Sydney region, along the coast through Victoria, South Australia, Tasmania and as far as Fremantle in

Western Australia. In 1986, it was estimated that the total breeding population in eighteen known colonies in NSW consisted of 17,000 pairs, most at the large colonies on Montague, Tollgate and Brush Islands. It is now believed to be closer to 49,000 birds at 22 known sites, however, the population in North Harbour/Manly is the only population known to breed on mainland NSW, and consists of only approximately 50 breeding pairs.

Little penguin nesting habitat normally consists of burrows built in sand dunes, rockpiles, sea caves, and occasionally under buildings. At Manly, a range of nest types are utilised, including under rocks on the foreshore, rock falls under seaside houses, garages, under stairs, in wood piles and under overhanging vegetation. Male penguins return to their colonies between June and August to reconstruct or dig new burrows and to attract females. About 3 months later, fledglings leave the nest and only return annually to moult until they are about 3 - 4 years old, when they return to breed.

Little penguins appear to be opportunistic feeders, foraging in relatively shallow waters. Their diet consists mainly of small schooling fish, like anchovies (*Engraulis australis*), pilchards (*Sardinops neopilchardus*), squid (Order Teuthida) and to a lesser extent, krill (Euphausiids). The population of penguins on Lion Island, in the Hawkesbury River, is also known to feed on blue sprats (*Spratelloides robustus*), small-mouthed hardyheads (*Atherinosoma microstoma*) and Ogilby's hardyheads (*Atherinomorus ogilbyi*).

The major threat to the Manly population is the loss of suitable habitat. Past development has greatly reduced available habitat in the area. Disturbance of little penguins and their habitat is also a major threat to the population. Predators such as dogs, cats, and foxes are known to take penguins from shallow burrows and as they move between the water and their nesting habitat. Commercial fishing has also been listed in the threat abatement plan as a threatening process, although there is currently no data to support the claim and fishing is not listed in the Act as a Key Threatening Process. Fishing, primarily hauling in this area, provides competition for food resources, disturbance due to noise outside burrows and may obstruct penguins from returning to their nests (NPWS, 2000b).

## **c) Vulnerable species**

### ***Plants***

#### **Wilsonia backhousei**

*Wilsonia backhousei* is a perennial, matforming, prostrate subshrub of the family Convolvulaceae. It often occurs as pure, or nearly pure, stands. At most sites, stands are limited in extent (in the order of a few 10m<sup>2</sup>). The most extensive stands occur around Jervis Bay. It is found in intertidal saltmarshes and, more rarely, on seacliffs. In NSW, *Wilsonia backhousei* is scattered along the coast, reaching its northern limit at Wamberal Lagoon. There has been a considerable decline in the abundance of the species this century, largely because of loss of habitat. It is also readily damaged by trampling and vehicle use, and recovery from damage is slow (NPWS Scientific Committee Final Determination newsletter).

### ***Reptiles***

#### **Green turtle (*Chelonia mydas*)**

Green turtles occur worldwide and are found in tropical and subtropical waters. They inhabit seagrass beds and coral reefs with a good cover of seaweed. Adult turtles are herbivores, feeding on seaweeds and seagrasses, whereas immature turtles feed on jellyfish, small molluscs, crustaceans and

sponges. Green turtles grow to an average of about one metre and are sexually mature generally between 91.5 – 122.5cm CCL. They may migrate up to 3000 km from feeding grounds in Indonesia, Papua New Guinea, New Caledonia, Fiji, Queensland, Northern Territory and Western Australia to breed and nest in southern and northern Great Barrier Reef, northwest Northern Territory, Gulf of Carpentaria, Western Australia, Coral Sea and Ashmore Reef. Nesting generally occurs from late November to January and earlier in the Northern Territory from July to December. They recruit from the pelagic phase as immature turtles (CCL = 40-50cm) to inhabit subtidal and intertidal coral and rocky reefs and seagrass meadows of the continental shelf. While they are most abundant within 1000 km of their nesting beaches, they live year round in coastal waters from central Western Australia, through Northern Territory and Queensland to central New South Wales, continuing to feed in waters as cool as 15°C. Green turtles are also listed as vulnerable under the EPBC Act 1999.

#### Leatherback turtle (*Dermochelys coriacea*)

Leatherback turtles are the largest of the marine turtles, with shells averaging 1.6 metres in length and with a total weight of up to 500 kg. They are so named because of their leathery shell, which is black with lighter spots and has five ridges. They inhabit tropical and warmer temperate waters, feeding on jellyfish and other soft bodied invertebrates. Unlike other marine turtles, leatherbacks spend almost their entire life feeding within the water column and are generally regarded as an oceanic species. Leatherback turtles do not nest in Australia in any numbers. Only a small population of leatherback turtles has been found breeding and nesting in eastern Australia, mainly from December to January. In Queensland, 1 - 3 females per year nest on Wreck Rock and adjacent beaches, and sporadic nesting occurs at other widely scattered sites in Queensland, New South Wales and the Northern Territory. In Western Australia, there are 2 - 6 sightings off the mid-west coast per year. The major breeding and nesting sites in the Asia/Pacific occur in Indonesia, Malaysia, Papua New Guinea and the Solomon Islands. They are listed as vulnerable under the EPBC Act 1999.

#### Loggerhead turtle (*Caretta caretta*)

Loggerhead turtles are found worldwide, inhabiting tropical and warmer temperate waters such as coral reefs, bays and estuaries. While they are most abundant within 1000 km of their nesting beaches, they live year round in coastal waters from southern Western Australia, through the Northern Territory and Queensland to southern New South Wales. The southern Great Barrier Reef and adjacent mainland near Bundaberg is the breeding centre of the eastern Australian population. Breeding is centred on Dirk Hartog Island (Shark Bay), Muiron Islands, Ningaloo and the North West Cape area for the western population. Loggerhead turtles eat shellfish, crabs, sea urchins and jellyfish. They reach sexual maturity at about 30 years or more and grow to an average of one metre in size. Loggerhead turtles migrate from feeding grounds in the Northern Territory, New South Wales and Queensland to the above nesting sites on the eastern and western Australian coastlines. Mating occurs from late October to early December, followed by nesting from late October to early March. They recruit from the pelagic phase as immature turtles (CCL = 70-80cm, >10 years) to inhabit subtidal and intertidal coral and rocky reefs and seagrass meadows as well as deeper soft-bottomed habitats of the continental shelf. They are listed as endangered under the EPBC Act 1999.

### ***Birds***

#### Australasian bittern (*Botaurus poiciloptilus*)

The Australasian bittern occurs from southern Queensland to Tasmania and southeastern South Australia, including most of Victoria and New South Wales. It also occurs in the southwestern corner of Western Australia. In NSW, the species has been recorded along the coast as well as in wetlands of

the Murrumbidgee and Lachlan Rivers and is frequently recorded in the Murray-Darling Basin. It inhabits terrestrial and estuarine wetlands, generally where there is permanent water with dense vegetation including sedges, rushes and reeds. Essentially a freshwater species, it also occurs in dense saltmarsh vegetation in estuaries and flooded grasslands. At dusk, the species forages in shallow water up to 30 cm deep, primarily feeding on frogs, fish, invertebrates (including crayfish), leaves and fruit. The major threats to the species include grazing and trampling of riparian vegetation and siltation of waterbodies by livestock, predation by foxes, regulation of waterways, clearing and draining of habitat, salinisation and pollution of wetlands and degradation of drought refuges.

Black bittern (*Ixobrychus flavicollis*)

The black bittern occurs from southern New South Wales, north to Cape York and along the entire northern coast to the Kimberley region. They also occur in the southwestern corner of Western Australia. In NSW, the species has been recorded scattered along the coast, rarely south of Sydney or inland. They inhabit freshwater and estuarine wetlands, generally where there is permanent water with dense vegetation. They occur in flooded grassland, forest, woodland, rainforest and mangroves. At dusk and at night, the species forages for reptiles, fish and invertebrates, including dragonflies, shrimp and crayfish. The major threats to the species include grazing and trampling of riparian vegetation by livestock, predation by feral cats, clearing and draining of habitat, and salinisation and pollution of wetlands.

Black-tailed godwit (*Limosa limosa*)

Godwits are migratory wading birds that breed in Mongolia and Siberia, and visit Australia during the summer, arriving in August and leaving in March. They are most common between Weipa and Darwin, but is also found in small numbers along much of the Queensland coast south of Cairns, south of Derby in Western Australia, the southeast of South Australia, and mainly around Port Phillip Bay in Victoria. In NSW, they have been regularly recorded only on Kooragang Island (Hunter River), with scattered sightings from both coastal and inland areas. Inland records, particularly within the Murray-Darling Basin, indicate that a regular inland passage is used. Godwits are primarily found along the coast on sand spits, lagoons and mudflats, and inland on mudflats of lakes and swamps. They have also been recorded in meadows and sewage treatment works. Their diet includes a variety of invertebrates such as insects and larvae, earthworms, crustaceans, molluscs, spiders, spawn and tadpoles of frogs and fish eggs. Threats to the species include hydrological changes to inland lakes and tourism or agricultural developments reducing coastal and inland habitat areas.

Broad-billed sandpiper (*Limicola falcinellus* subsp. *sibirica*)

This subspecies of sandpiper are migratory wading birds that breed in north and northeastern Soviet Union, and visit India, southeast Asia and Australia during the summer. In Australia, they are most common along the northern coasts, particularly the northwest, with occasional birds seen on the southern coasts and very few inland. In NSW, the main site for the species is the Hunter River, with records along the coast south to Shoalhaven River. They are known to favour estuarine sand- and mudflats, particularly areas of soft mud on the seaward side of mangroves, saltmarshes and reefs as feeding and roosting habitat. They have also been recorded in shallow freshwater lagoons and sewerage treatment works. Their diet includes insects, worms, crustaceans, molluscs and seeds. Threats to the species include hydrological changes to inland lakes (for individuals that remain in Australia over winter) and development of coastal estuaries, mudflats and saltmarshes.

Comb-crested jacana (*Irediparra gallinacea*)



In Australia, comb-crested jacanas occur in the north and northeast of the country, originally from the Kimberley region east to about the Hunter region in NSW. They are thought to have expanded this range, however, and are now recorded as far south as Bermagui (Marchant and Higgins, 1993). They are found primarily in freshwater wetlands, lagoons, billabongs, swamps, lakes and rivers where there is an abundance of floating aquatic vegetation, particularly waterlilies, nardoo or milfoil. They feed on seeds and aquatic insects from amongst aquatic vegetation and debris. They nest on loosely constructed platforms of aquatic vegetation up to 10 m wide and in NSW, breeding takes place between September and April.

#### Freckled duck (*Stictonetta naevosa*)

Essentially a freshwater species, freckled ducks also occur in coastal districts of southeastern and southwestern Australia, particularly during drought years. Eastern breeding grounds include the Murray-Darling Basin, Lake Eyre and southwestern Queensland. In coastal areas, they prefer swamps heavily vegetated with ti-trees. They feed on algae, seeds and the vegetative parts of various aquatic grasses and sedges, small crustaceans, zooplankton, worms, insects and small fish. Threats to the species include loss of habitat and breeding sites, river regulation and illegal hunting.

#### Great knot (*Calidris tenuirostris*)

Knots are migratory wading birds that breed in Siberia and migrate to Australia in large numbers from late August, leaving in March and April. Some individuals may stay over winter. They occur throughout Australia, including the coastal islands of Tasmania, but is most common and abundant in the north, and uncommon to rare further south. In NSW, they have been recorded in scattered sites along the coast to about Narooma, and are primarily found within sheltered, coastal habitats containing large intertidal sand- and mudflats, including in inlets, bays, harbours, estuaries and lagoons. They have also been recorded on exposed reefs or rock platforms. Their diet includes bivalve molluscs, gastropods, polychaete worms and crustaceans. Threats to the species include hydrological changes to inland lakes (for those that remain over winter) and tourism or agricultural developments reducing coastal and inland habitat areas.

#### Greater sand plover (*Charadrius leschenaultii*)

Sand plovers are migratory wading birds that breed in central Asia and migrate to Australia in summer. The species is commonly recorded on the west coast, but is apparently rare on the east coast. In NSW, they have been recorded in coastal areas from the northern rivers region south to Shoalhaven Heads, with the majority of birds recorded in the Clarence and Richmond Rivers. They forage on intertidal sand- and mudflats in estuaries, and roost during high tide on sandy beaches or rocky shores. They have also been recorded on inshore reefs, rock platforms, and small rocky islands and sand cays on coral reefs. Their diet includes insects, molluscs and crustaceans. Threats to the species include hydrological changes to the Clarence and Richmond Rivers and tourism or agricultural developments reducing coastal and inland habitat areas.

#### Lesser sand plover (*Charadrius mongolus*)

Lesser sand plovers are migratory wading birds that breed in eastern Siberia, southern Mongolia, western China and the Himalayas and migrate to the coasts of eastern and southern Africa, the Middle East, India, Southeast Asia and Australia in summer. The species occurs around the entire coastline of Australia but is most abundant in the Gulf of Carpentaria and along the east coast of Queensland and northern NSW. They are rarely recorded south of Shoalhaven River. They favour beaches, sandflats, mudflats and mangroves within estuaries, and roost during high tide on sandy beaches or rocky shores. In NSW, important estuaries for them include Port Stephens, Harrington Inlet

and the Clarence and Richmond Rivers. Their diet includes crustaceans, molluscs, insects and polychaete worms. Threats to the species include hydrological changes to the Clarence and Richmond Rivers and tourism or agricultural developments reducing coastal and inland habitat areas.

Mangrove honeyeater (*Lichenostomus fasciocularis*)

Mangrove honeyeaters are found in mangroves and adjacent woodlands of coastal northeastern Australia, from Townsville in Queensland to Macksville in NSW (Pizzey and Doyle, 1984; Simpson and Day, 1996). Their nest consists of a deep cup of fine dry grass or dried seagrass in the fork of mangrove trees down to 60 cm above the high water mark. They usually feed on the blossoms of mangrove trees, but also descend to the mangrove floor at low tide to feed among the trunks and roots.

Osprey (*Pandion haliaetus*)

Ospreys have a disjunct distribution around the Australian coastline, occurring in the north from Broome in WA to the south coast of NSW, in the south from Kangaroo Island to the Great Australian Bight, and from Esperance to Cape Keraudren in the west (Marchant and Higgins, 1993). In NSW, the osprey occurs primarily along the coast, south to about Womboyn Lake and is found in greater numbers in the north of the State (Marchant and Higgins, 1993). They require extensive areas of clear, open water for fishing, often ranging up into freshwaters of larger rivers. They are found on offshore islands, littoral habitats, terrestrial wetlands and coastal lands of tropical and temperate Australia (Marchant and Higgins, 1993). They nest in prominent positions near the ocean or large waterbodies, on rocky headlands, stacks, cliffs, palm trees, in tall dead trees, and on artificial platforms (Marchant and Higgins, 1993). More recently, particularly on the north coast of NSW, ospreys have been nesting on electrical supply poles as they provide the type of vantage points of their former natural habitat. The NPWS and NorthPower have been working together to customise these poles to avoid electrocution and to provide stable nesting platforms. They feed mostly on fish, clutching them from the surface of the water or diving to less than 1 m, and are able to eat toxic (Diodontidae, Tetraodontidae) and spiny fishes (Balistidae and Acanthuridae). They also feed on terrestrial vertebrates, seabirds and crustaceans (Marchant and Higgins, 1993). Osprey are tolerant of human activity, often nesting within or adjacent to urban areas, but over clearing and degradation of water quality are likely to have an adverse impact on their nesting and feeding habitat (Marchant and Higgins, 1993).

Pied oystercatcher (*Haematopus longirostris*)

The pied oystercatcher is distributed along the entire Australian coastline and offshore islands, with most key sites located in the southeast. These include The Coorong in SA, Derwent River in Tasmania and Corner Inlet in Victoria (Marchant and Higgins, 1993). They roost and forage on sandy beaches, mudflats, sandbanks and rocky shores, and occasionally roost in mangroves. They also forage on oyster leases, but are more common at the low water mark on beaches where they probe soft substrata for molluscs, worms and crabs and sometimes take small fish from shallow water. They nest on sandy beaches, sandbars and along estuaries, immediately above the high water mark, as well as on sand dunes or saltmarshes and mudflats (Marchant and Higgins, 1993). Threats to the species include alteration of habitat, human disturbance, destruction of nests and predation by foxes.

Sanderling (*Calidris alba*)

Sanderlings are an uncommon to locally common migrant from Siberia and other breeding grounds within the Arctic. They generally spend the summer in coastal areas of northern and eastern Australia and some individuals remain over winter. Sanderling prefer open sandy beaches exposed to open sea-swell, exposed sand bars and spits, and are also found in coastal areas on low beaches of firm

sand, near reefs and inlets, along tidal mudflats and bare coastal lagoons. In NSW, important estuaries for them include Harrington Inlet and Old Bar at the mouth of Manning River. They forage at the edge of the water in the wave-washed zone and sometimes among rotting kelp, as well as at the edges of shallow pools on sandspits and mudflats. Their diet consists of insects and their larvae, crustaceans, jellyfish, fish, spiders, worms, plants and seeds, and larger molluscs and crustaceans are also taken as carrion. Threats to the species include hydrological changes to estuaries and similar waterbodies that may modify or remove habitat, and tourism or agricultural developments reducing coastal and inland habitat areas.

#### Sooty oystercatcher (*Haematopus fuliginosus*)

Sooty oystercatchers are endemic to Australia and are widespread along the east, west and south coasts, with scattered records from northern Australia. There are thought to be only small numbers of birds in NSW distributed evenly along the coast (Marchant and Higgins, 1993), although the coastline between Lake Conjola and Lake Tabourie is thought to support more than 1% of the Australian population (Carter, 1995). They are a strictly marine coastal species, preferring rocky intertidal shorelines with a minimal cover of foliose algae, coral reefs or sandy beaches near intertidal mudflats. They also occasionally forage on oyster leases, but are more common on intertidal rock platforms where they feed on molluscs, crustaceans, ascidians, echinoderms and small fish. When feeding on beaches, they take worms, larvae of seaweed flies and sandhoppers. They nest on offshore islands and rock stacks, often close to rocky coasts, and sometimes on remote headlands, promontories or steep beaches (Marchant and Higgins, 1993).

#### Terek sandpiper (*Xenus cinereus*)

The Terek sandpiper is a non-breeding migratory visitor to Australia's west, north and east coasts. In NSW, the species has been recorded from the Northern Rivers region south to Lake Wollumboola. The two main sites are the Hunter and Richmond Rivers, with the Hunter identified as nationally and internationally important for the species. They prefer muddy beaches near mangroves, coastal mudflats, lagoons, creeks and estuaries, but have been observed on rocky pools and coral reefs and occasionally up to 10 km inland around brackish pools. Their diet consists of polychaete worms, crustaceans, small shellfish, beetles, waterbugs, and the adults and larvae of various flies. Threats to the species include hydrological changes to estuaries that may modify or remove habitat, tourism or agricultural developments reducing coastal and inland habitat areas, urban and industrial development, and disturbance by recreational activities.

### ***Marine mammals***

#### Humpback whale (*Megaptera novaeangliae*)

Humpbacks have a worldwide distribution, but spend the summer months feeding in pelagic waters of Antarctica, generally between 60 – 70°S. In winter and spring, they migrate to warmer breeding grounds, 15 – 20°S, and are recorded in coastal waters off all States of except for the Northern Territory. There is distinct Northern and Southern Hemisphere populations based on temporal migration separation, and there are thought to be at least six Southern Hemisphere populations. Two of these populations are recorded off Australia's coastline, one off the west coast and the other off the east coast. There is thought to be a sex ratio bias towards males in east coast migration, and a possibility that not all females migrate north each year. Key localities within Australian waters include: Cape Naturaliste/Geographe Bay, north of Rottnest Island, Shark Bay, North West Cape, off Dampier Archipelago and coastal islands off Kimberley in Western Australia; southern coast, off Coffs Harbour and Cape Byron in New South Wales; Stradbroke Island, Hervey

Bay, and islands in Great Barrier Reef, especially Whitsunday Passage area off Queensland. The exact locations of breeding grounds are unknown, although breeding occurs in the central Great Barrier Reef area and there is probably a wide range of opportunity for breeding over several degrees of latitude on both the east and west coasts. Humpbacks feed mainly in Antarctic waters almost exclusively on krill (*Euphausia superba*). Elsewhere they feed on small shoaling fish and occasionally benthic organisms, and there is some evidence of feeding on fish and plankton swarms in warmer waters, e.g. off Eden and on larval *Munida gregaria* during their southern migration off New Zealand. Catches in the subtropics off northwest Western Australia and eastern Australia showed almost no evidence of local feeding. They feed by variety of methods, generally determined by their location. In the Southern Hemisphere, they feed by swallowing large volumes of prey and water or by disturbing the water, creating a washing machine effect. In the Northern Hemisphere, they feed by lunging and bubble feeding, which involves production of a bubble net formed by exhalation under water, concentrating prey. Humpbacks were heavily exploited by commercial operations until about 1970, and estimates suggest the population may have been reduced to 5% of its initial size by 1963. Despite international protection since then, recovery seems to have been delayed until mid-1970s, possibly mainly through continued illegal catches until about 1970. Current threats are thought to include direct disturbance on migration path and in breeding areas by:

- whale watching and research vessels/aircraft, pleasure craft, swimmers and divers
- coastal seismic operations
- defence operations
- collision with large vessels
- entanglement in fishing gear/shark nets
- pollution, including increasing amounts of plastic debris at sea, oil spills and dumping of industrial wastes into waterways and the sea, leading to accumulation of toxic substances in body tissues, although this is likely to be minimal given that it rarely feeds in low latitudes (Bannister *et al.*, 1996).

Humpback whales are also classified as vulnerable under the EPBC Act.

#### Indo-Pacific humpbacked dolphin (*Sousa chinensis*)

This dolphin occurs in southern China, through the Indo–Malay Archipelago to northern and northeastern Australia, where it is most regularly recorded in Western Australia (north of 24°S), Northern Territory and Queensland, with occasional strandings reported in New South Wales (mostly north of 29°S). They are primarily a coastal species, occurring in estuaries and rivers of tropical and subtropical climates. They occur close to the coast, in less than 20 m depth, although aerial surveys in the Great Barrier Reef region may have located them in waters between the outer reef and the mainland, further from shore than has been previously reported in the literature. Key localities for the species in Australia include Moreton Bay, Tin Can Inlet and Great Sandy Strait in Queensland. Their diet consists of a variety of species of fish, some cephalopods and crustaceans. They have been known to feed in association with prawn trawlers in Moreton Bay, and presumably elsewhere throughout their range in Australia. There is no reliable data on mortality rates or on abundance. In Moreton Bay, 36% of dolphins show evidence of shark attack, suggesting mortality from sharks may be significant. In South Africa, many animals also have very high levels of organochlorines, probably sufficiently high to kill a female's first calf, and it is possible that similar high pollutant loads occur in dolphins of Moreton Bay, but no data are available at present. Threats to the species are thought to include habitat

destruction and degradation, noise pollution, harassment or disturbance (particularly close to major cities as in Moreton Bay), incidental capture in shark nets and trawl-nets, illegal killing, and overfishing of prey species. They are also prone to live capture for display purposes, in Queensland (permits granted for up to 12 per year at present) and northern NSW. Other potential threats include pollution and mass mortalities induced by pathogens.

#### Southern right whale (*Eubalaena australis*)

Southern right whales are circumpolar and only found in the southern hemisphere between approximately 30° and 60°S. They move from pelagic waters of higher latitudes where feeding occurs in summer, to warmer, lower latitudes for breeding in winter, when they approach close to the coast. In Australia, they are distributed around the southern coastline from Perth, WA to Sydney, NSW, including Tasmania. Their range is possibly extending, with recent sightings from Shark Bay and North West Cape, WA and north of Sydney to Cape Byron, NSW. Adult females are sighted most frequently close to coast, coming inshore to give birth on a mainly three-year cycle. Little is known about the diet of southern rights, but observations, lack of suitable prey and whaling data imply that they do not feed near the coast in winter, with calving females effectively fasting for at least four months. Prey is thought to be mainly pelagic larval crustaceans, particularly *Munida gregaria* and copepods. They are taken primarily during summer in the open ocean, south of about 40°S. Threats to the species are thought to include historical gross exploitation at least into the late 1960s, and despite international protection, is likely to have prevented significant recovery until recently. More recent threats are thought to include direct disturbance, particularly in near-shore concentration/calving areas, from:

- whale watching and research vessels/aircraft, pleasure craft, swimmers and divers
- low-flying aircraft
- coastal industrial activity, e.g. seismic, drilling, sandmining and shipping operations
- defence operations
- collision with large vessels, particularly on shipping routes on eastern seaboard, in Bass Strait and across the Great Australian Bight
- entanglement in fishing gear.

Potential threats are thought to include increased whale watching pressure, industrial activity and pollution levels, and these may all be compounded by an increase in right whale numbers. The latter will also affect availability of suitable coastal calving habitat (Bannister *et al.*, 1996). Southern right whales are also classified as vulnerable under the EPBC Act.

