



# Fisheries Victoria Assessment Report Series

## Victorian Snapper Stock Assessment 2011

No. 64  
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# **Victorian Snapper Stock Assessment 2011**

Kemp J, Conron S, Hamer P, Bruce T, Bridge N and Brown L

**June 2012**

**Fisheries Victoria**

**Assessment Report Series No. 64**

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# Snapper Assessment Summary 2011

## Victoria's snapper stocks

Two separate stocks (i.e. populations) of snapper (*Chrysophrys auratus*) occur in Victorian waters (see map):

- The fisheries to the east of Wilsons Promontory, including Corner Inlet, are based on the eastern snapper stock
  - The eastern stock is distributed up the eastern coast of Australia through NSW and into southern Queensland waters
- The fisheries to the west of Wilsons Promontory including Port Phillip Bay and Western Port, are based on the western snapper stock
  - Port Phillip Bay provides critical spawning and nursery habitat for the western snapper stock
  - Most of the adult snapper found west of Wilsons Promontory were spawned and raised in Port Phillip Bay.

The fisheries based on the eastern and western snapper stocks are managed separately.

## Victoria's snapper fisheries

In Victoria snapper are caught in:

- Port Phillip Bay
- Corner Inlet
- Coastal waters
- Western Port.

In Victoria most of the snapper are caught from bays, inlets and coastal waters to the west of Wilsons Promontory (i.e. they belong to the western stock).

## Types of fisheries

Both commercial and recreational fisheries for snapper occur in Victoria.

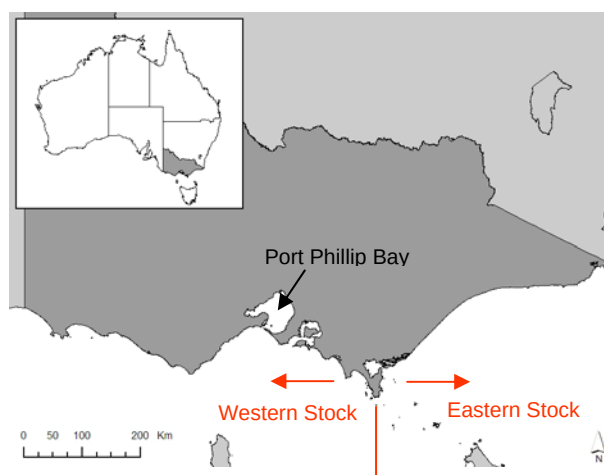
### Commercial fisheries

Commercial fishers catch snapper using long-lines (65%) and haul seines (24%). Snapper are also caught in inshore coastal waters by trawlers.

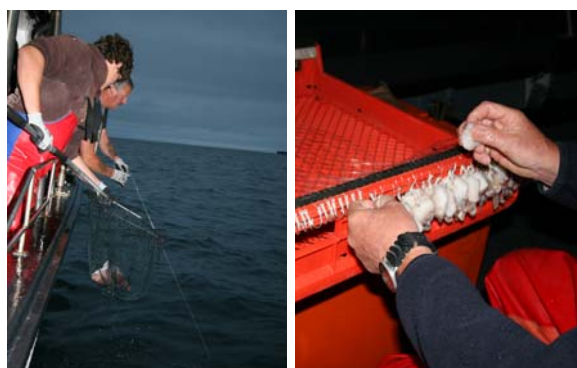
Commercial fisheries operate mainly in Port Phillip Bay (supplying 92% of the catch), coastal waters (5%) and Corner Inlet (3%). A small catch comes from the Western Port long-line fishery.



Snapper, *Chrysophrys auratus*. Photo credit: Lauren Brown



The location of western and eastern snapper fisheries in Victoria.



Port Phillip Bay snapper long line operations. Photo credit: Lauren Brown

## Recreational fisheries

Recreational fishers catch snapper mostly from boats using baited hooks and lines, though some shore-based line fishing occurs.

Most of the recreational catch of snapper comes from Port Phillip Bay, though small fisheries operate in coastal waters to both the west and east of Wilsons Promontory and in Western Port.

## Management of Fisheries

Fisheries Victoria is responsible for managing fisheries and fish resources under the provisions of the *Fisheries Act 1995* and the *Fisheries Regulations 2009*.

National guidelines for ecologically sustainable development (ESD) of fisheries are used to identify environmental, biological, economic, social and governance dimensions for individual fisheries.

These ESD principles underpin the three key strategic goals of Fisheries Victoria:

- 'Securing' fisheries resources
- 'Sharing' fisheries resources
- 'Growing' or developing the value of the resource for the benefit of the community.

## Stock assessments

Stock assessments are designed primarily to provide information on the status of fish stocks in Victoria's bays and inlets to help address the biological sustainability and management arrangements.

## Snapper Stock Assessment 2011

A formal assessment of Victorian snapper stocks was conducted at the Department of Primary Industries, Queenscliff, Victoria in May 2011.

The assessment workshop was attended by:

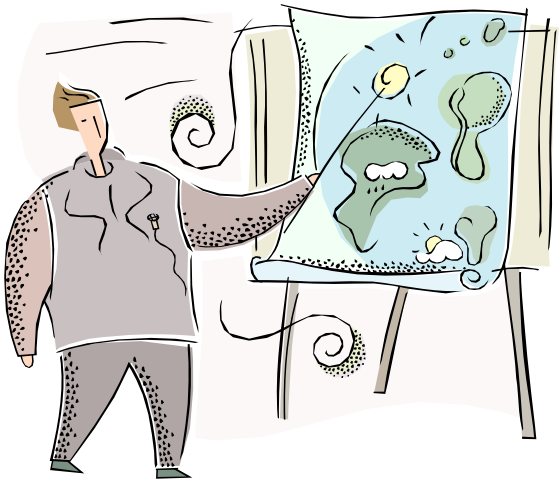
- Representatives of the commercial and recreational fishing sectors
- Fisheries Victoria managers and scientists
- Experienced recreational and commercial fishers.

The stock assessment is detailed in this report and a summary presented below.

Recreational anglers prize snapper.



Assessing information about the condition of



fish stocks and the impacts of fishing ensures sustainable fisheries.



Healthy Snapper stocks ensure great fisheries.

## Status of the Western Snapper Fishery

### Stock condition

Victoria's western stock of adult snapper is in good condition.

### Catch rates

Catch rates in the western snapper fishery are mostly above long-term averages.

### Spawning success

Exceptionally strong year classes spawned in 2000/01 and 2003/04 are driving current record high catch rates for both the commercial and recreational fishing sectors.

Despite major recruitment failures in 2005/06, and 2010/11, recent consecutive years of moderate recruitment (2007/08, 2008/09, 2009/10) are expected to provide average abundance of 'pinkies' over the next few years.

### Future fishery strength

A reduction in catch rates of larger snapper is expected over the next few years; however, this will be moderated by the strong 2003/04 and 2004/05 year classes, and in the longer term by the moderate 2007/08 to 2009/10 year classes.

### Management arrangement

Fishery and scientific survey data presented to stakeholder and Departmental participants at the May 2011 stock assessment workshop did not indicate the need for a review of snapper management arrangements, and participants supported that the current management regime should be maintained.

### Areas of concern

A recent increase and current high take of snapper by commercial trawlers necessitates additional data collection.

Data required to assess the impact of this catch on the western snapper stock include:

- Age and length composition of the catch
- Age and length composition of the discarded fish
- Catch data and effort data reported at both spatial and temporal scales.

More data on the coastal water snapper fishery by both the commercial and recreational sectors are required to improve the western snapper stock assessment.

## Overview of the status of the Western Snapper Stock

|                                                                                                                                                                                                                                                     |
|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Stock Condition - Good</b>                                                                                                                                                                                                                       |
| <b>Break down by fishery indicators</b>                                                                                                                                                                                                             |
| <b>Recent spawning success (Port Phillip Bay)</b> ↓ <ul style="list-style-type: none"> <li>• Moderate recruitment</li> <li>• Average abundance expected</li> </ul>                                                                                  |
| <b>Catch rates – Port Phillip Bay</b> <ul style="list-style-type: none"> <li>• Above the long term average for <ul style="list-style-type: none"> <li>o Recreational fisheries</li> <li>o Long-line and haul seine fisheries</li> </ul> </li> </ul> |
| <b>Catch rates – Western Port Bay</b> <ul style="list-style-type: none"> <li>• Limited data for long-line fisheries</li> <li>• Stable or above the long-term for recreational catches</li> </ul>                                                    |
| <b>Catch rates – Coastal waters</b> <ul style="list-style-type: none"> <li>• Limited data for recreational fisheries</li> <li>• Above the long term average for commercial fishers</li> </ul>                                                       |
| <b>Stock structure– Port Phillip Bay</b> <ul style="list-style-type: none"> <li>• Age and size class within historical range for both commercial and recreational fisheries</li> </ul>                                                              |
| <b>Stock structure– Western Port Bay</b> <ul style="list-style-type: none"> <li>• Based only on data derived from the recreational fishery</li> <li>• Age and size class within historical range</li> </ul>                                         |
| <b>Management settings</b>                                                                                                                                                                                                                          |
| <ul style="list-style-type: none"> <li>• Maintain current settings</li> </ul>                                                                                                                                                                       |
| <b>Flagged issues</b>                                                                                                                                                                                                                               |
| <ul style="list-style-type: none"> <li>• Monitor recruitment in Port Phillip Bay</li> <li>• Large increase in commercial catch of snapper in coastal waters since 2007.</li> </ul>                                                                  |

### Legend

|                             |
|-----------------------------|
| <b>Good condition.</b>      |
| ↑ Improving                 |
| ↓ Decreasing                |
| <b>Poor condition</b>       |
| ▶ Requires close monitoring |
| Limited data                |

## Status of the Eastern Snapper Fishery

### Stock condition

The condition of the eastern stock of snapper is unknown.

Catches from Victorian waters in the snapper fisheries are low and unlikely to have a major impact on a stock that extends north to Queensland.

### Spawning success

Unknown.

### Future fishery strength

Unknown.

### Management arrangement

Fishery and scientific survey data presented to stakeholder and Departmental participants at the May 2011 stock assessment workshop supported that the current management regime should be maintained.

### Areas of concern

More data on the snapper fisheries to the east of Wilsons Promontory by both the commercial and recreational sectors are required to improve the assessment of the eastern snapper stock.

## Overview of the status of the Eastern Snapper Stock

|                                                                                                                                                                              |
|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Stock Condition - unknown</b>                                                                                                                                             |
| <b>Break down by fishery indicators</b>                                                                                                                                      |
| <b>Recent spawning success</b> <ul style="list-style-type: none"> <li>Limited data</li> </ul>                                                                                |
| <b>Catch rates – Corner Inlet</b> <ul style="list-style-type: none"> <li>Limited data from the commercial fishery</li> <li>No data from the recreational fishery.</li> </ul> |
| <b>Catch rates – Coastal waters</b> <ul style="list-style-type: none"> <li>No data</li> </ul>                                                                                |
| <b>Stock structure</b> <ul style="list-style-type: none"> <li>No data from either sector</li> </ul>                                                                          |
|                                                                                                                                                                              |
| <b>Management settings</b> <ul style="list-style-type: none"> <li>Maintain current settings</li> <li>Limited catch</li> <li>Large stock extends north</li> </ul>             |
| <b>Flagged issues</b> <ul style="list-style-type: none"> <li>No data</li> </ul>                                                                                              |

### Legend

|                                                                                                               |
|---------------------------------------------------------------------------------------------------------------|
| Good condition.                                                                                               |
| ↑ Improving                                                                                                   |
| ↓ Decreasing                                                                                                  |
| Poor condition                                                                                                |
|  Requires close monitoring |
| Limited data / unknown                                                                                        |

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# Introduction

Fisheries Victoria has developed a process to conduct periodic formal assessments of the status of key marine and estuarine finfish stocks and the fisheries they support. This process involves:

- The synthesis of all relevant fisheries data
- Evaluation of fisheries-independent monitoring and research data, where available
- Convening of a workshop involving scientists, resource users and resource managers to assess the status of the stock/fishery in question
- Production of an assessment report which provides scientific information and advice to facilitate fishery management decision making.

The assessment process:

- Provides scientific evidence on the status of the fish stocks and the environmental factors and harvest pressures that influence stock abundance
- Provides opportunity to draw on the knowledge of stakeholder groups
- Underpins evidence-based decisions in an ecologically sustainable management context
- Complements Victorian fisheries management planning processes
- Ensures the fishery assessment process is accountable and transparent.

A formal assessment of Victorian snapper (*Chrysophrys auratus*) stocks was conducted at the Department of Primary Industries, Queenscliff, Victoria in May 2011.

The assessment workshop was attended by representatives of the commercial and recreational fishing sectors, Fisheries Victoria managers and scientists, and experienced recreational and commercial fishers.

## This report

This report assesses the status of the western and eastern snapper stocks using data collected from the fisheries (both recreational and commercial) and from fishery independent scientific monitoring.

The report is structured as a series of tables which describes:

- The stock structure of snapper in Victoria
- The snapper fisheries that operate in Victorian coastal waters
- Fisheries management arrangements currently in place to control fishing effort
- The types of data used in the assessment
- The indicators of performance against which the status of the stocks are assessed
- The trends in the data for each indicator
- The status matrix for each snapper stock in Victoria.

These tables are underpinned by a series of appendices which:

- Detail the data used in the assessment
- Outline the stakeholders assessment of the snapper fishery
- Describe the major findings of previous assessments
- Summarise the life history of snapper
- Detail data collection methods
- Details commercial fishing activities used in the snapper fisheries.

# Description of the snapper stocks

---

|                            |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General description</b> | <p>Two separate stocks (i.e. populations) of snapper occur in Victorian waters (see map):</p> <ul style="list-style-type: none"><li>• The fisheries to the east of Wilsons Promontory including Corner Inlet are based on the eastern snapper stock. The eastern stock is distributed up the east coast of Australia through NSW and southern Queensland waters</li><li>• The fisheries to the west of Wilsons Promontory including Port Phillip Bay and Western Port, are based on the western snapper stock. Port Phillip Bay provides critical spawning and nursery habitat for the western snapper stock. Most of the adult snapper found west of Wilsons Promontory, were spawned and raised in Port Phillip Bay.</li></ul> <p>The fisheries based on the eastern and western snapper stocks are managed separately.</p> |
| <b>Fishing areas</b>       | <p>In Victoria snapper is harvested from the marine waters of:</p> <ul style="list-style-type: none"><li>• Port Phillip Bay</li><li>• Corner Inlet</li><li>• Western Port</li><li>• Coastal waters.</li></ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

---

# Description of the fisheries

|                            | Commercial fisheries                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    | Recreational fishery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
|----------------------------|-------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>General description</b> | <p>In 2009/10, the total catch of snapper taken by Victorian licensed commercial fishers was 90 tonnes (3% of the total Victorian finfish catch) (Figure 1).</p> <p>This had a wholesale market value of \$0.7 million (8% of the total Victorian finfish market value). Victorian commercial snapper catches have ranged between 90 and 115 tonnes for the past five years.</p>                                                                                                                                                                                        | <p>For 2000/01, it was estimated that ~474 000 snapper (~330 tonnes) were taken by the Victorian recreational fishery, constituting 5% of the total state-wide recreational catch (by numbers) in marine waters (Henry and Lyle 2003).</p> <p>For 2006/07, it was estimated that ~612 000 snapper (~332 tonnes) were taken by the Victorian recreational fishery (Ryan <i>et al.</i> 2009). The majority of the recreational catch of snapper is taken from Port Phillip Bay, followed by coastal waters west of Wilsons Promontory, Western Port, and the coastal waters east of Wilsons Promontory.</p> |
| <b>Fishing methods</b>     | <p>In 2009/10, commercial catches of snapper in Victorian waters were primarily taken using long-lines (65%) and haul seines (24%).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                 | <p>Snapper are caught by anglers from the shore-line, but are most commonly targeted by anglers from boats.</p> <p>Anglers targeting snapper, use:</p> <ul style="list-style-type: none"> <li>• Chemically sharpened hooks</li> <li>• A range of hook sizes (2/0–6/0); depending on bait size</li> <li>• A range of lines (4–10 kg); depending on the depth and substrate, and size of fish being targeted</li> <li>• Squid, cuttlefish, octopus, silver whiting, garfish and pilchard as bait.</li> </ul>                                                                                                |
| <b>Fishing areas</b>       | <p>In 2009/10, the majority of Victoria's commercial catch of snapper was taken from Port Phillip Bay (92%), followed by coastal waters (5%), and Corner Inlet (3%). Catches from Western Port in 2009/10 were &lt;0.1 tonnes.</p> <p>The majority of the commercial catch of snapper harvested from Port Phillip Bay by long-lines comes from the centre and west of the bay, and the Geelong Arm, typically in waters &gt;10 m. The majority of the snapper catch by haul seines comes from areas in the north west of Port Phillip Bay, in waters &lt;10 m deep.</p> | <p>The majority of the recreational catch of snapper harvested from Port Phillip Bay and within this bay is caught from the Bellarine Peninsula, Mornington Peninsula and the northern and eastern region of the bay from Frankston to Altona.</p>                                                                                                                                                                                                                                                                                                                                                        |
| <b>Seasonality</b>         | <p>Commercial catches of snapper from Port Phillip Bay (all gear types combined) are highest during November/December (late spring /early summer).</p> <p>This peak in catches coincides with the seasonal movement of snapper into Port Phillip Bay for spawning.</p>                                                                                                                                                                                                                                                                                                  | <p>Recreational catches of snapper from Port Phillip Bay are highest during late spring and early summer.</p> <p>This peak in catches coincides with the seasonal movement of adult snapper into Port Phillip Bay for spawning.</p>                                                                                                                                                                                                                                                                                                                                                                       |

# Management arrangements

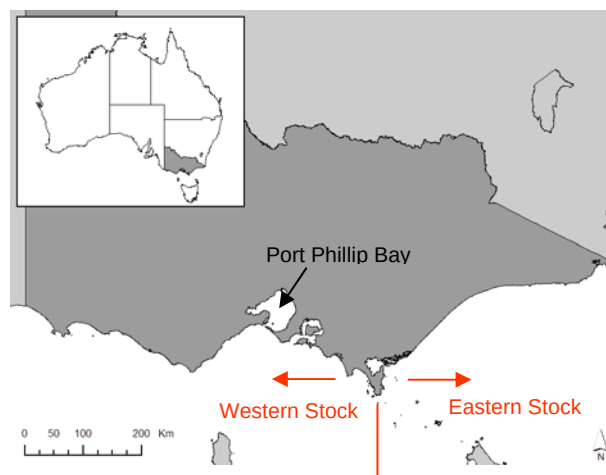
| Commercial fishery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                     | Recreational fishery                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
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| <p>Commercial snapper catches occur as a component of a multi-species commercial finfish fishery.</p> <p>The commercial fishery is currently managed primarily by:</p> <ul style="list-style-type: none"> <li>• Input (effort) controls (including limited entry licensing, restrictions on fishing equipment and methods, and closed areas/seasons)</li> <li>• Indirect catch controls such as legal minimum size limits.</li> </ul> <p>The number of licensed commercial fishers in Victorian waters was reduced by a third between 1986/87 and 2010/11. The majority of the licence removals occurred as a result of voluntary licence buy-back schemes conducted in 1999/00 and 2005/06.</p> <p>In 2011, there were:</p> <ul style="list-style-type: none"> <li>• 42 commercial licence holders in Port Phillip Bay and Western Port</li> <li>• 18 licence holders in Corner Inlet</li> <li>• 246 licences holders in Victorian coastal waters (ocean general)</li> <li>• 60 inshore trawl licence holders.</li> </ul> <p>In 2009/10, the number of commercial boats (not licences) reporting catches of snapper were as follows:</p> <ul style="list-style-type: none"> <li>• 47 in Port Phillip Bay</li> <li>• 3 in Western Port</li> <li>• 11 in Corner Inlet</li> <li>• 38 in the coastal waters west of Wilsons Promontory</li> <li>• 9 in the coastal waters east of Wilsons Promontory.</li> </ul> <p>Western Port was closed to commercial haul seine and mesh net fishing in December 2007. Long line fishing continues in this bay, although is considered to be exceptionally rare.</p> | <p><b>Recreational fishing licence</b></p> <p>Since 15 July 1999, recreational fishers have been required to hold a recreational fishing licence (RFL) to fish in marine and inland waters. Recreational fishers under 18 years of age or over 70 years of age, or those holding one of a range of concession cards are not required to hold a licence.</p> <p><b>Gear restrictions</b></p> <p>Recreational fishing remained unrestricted, other than size limits, until 1992, when regulations specified a maximum of four lines per person and two hooks per line when fishing in marine waters, and a maximum of two lines with two hooks per line in inland waters (MacDonald 1997).</p> <p>This regulation was modified in 2009 to include two hooks per line or one bait jig when fishing in both marine and inland waters.</p> <p><b>Bag and size limits</b></p> <p>A daily bag limit (DBL) and possession limit of 10 snapper per person (of which no more than three fish may be equal to or exceed 40 cm TL) applies to recreational fishing for snapper in all Victorian waters.</p> <p>The minimum legal size for snapper is 28 cm TL. No more than three fish may be equal to or exceed 40 cm TL.</p> |

# Assessment data and methods

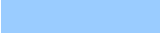
| Source                                | Description                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                               |
|---------------------------------------|-----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Fishery-independent</b>            | <p><b>Snapper beam trawl survey</b><br/>A small beam trawl (Hamer and Jenkins 2004) has been used to survey the relative abundance of 2–4 month old snapper (i.e. age 0+, 4–10 cm TL) in Port Phillip Bay since 2000. This survey is ongoing, and involves sampling at nine areas around the bay in March to coincide with the end of the larval settlement period. Each sampling event consists of five non-overlapping trawls of 10 minutes bottom time within each of the nine sampling areas. The survey is conducted at night.</p> <p><b>Multi-species otter-board trawl survey</b><br/>This survey of fish communities in Port Phillip Bay involved a large wing- or otter-board trawl net (Parry <i>et al.</i> 2002). The survey has occurred from 1994 to 2011, but recently ceased. Trawl samples were taken at 22 fixed sites stratified by depth (7, 12, 17, and 22 m) along 6 transects spread around the bay. Sites were sampled typically in March. At each site two trawls were undertaken, so that a total of 44 trawl samples were completed annually. The duration of each trawl shot was ~5 minutes. Most of the snapper taken by the otter-board trawl survey are 1 year old.</p> <p><b>Volunteer research angler diary program (RAD)</b><br/>A voluntary research angler diary program was established in 1997 provides time-series data on recreational angler catch rates, and the size/age composition of key target species.</p> |
| <b>Commercial fishery-dependent</b>   | <p>Victorian commercial fishers are required as a condition of their licence to record their fishing activities in a logbook and to submit this information to DPI. Commercial fishers provide the following information:</p> <ul style="list-style-type: none"> <li>• Gear code and net length/number of hooks/jigs</li> <li>• Area code</li> <li>• Number of shots</li> <li>• Fishing time</li> <li>• Weight of species caught and not returned to the water.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                |
| <b>Recreational fishery-dependent</b> | <p><b>Offsite telephone diary surveys</b><br/>Off-site telephone diary surveys of recreational fishing were carried out in 2000/01 (Henry and Lyle 2003) and 2006/07 (Ryan <i>et al.</i> 2009) to provide regional and State-wide estimates of total recreational catches of key target species, including snapper.</p> <p><b>Onsite access point creel surveys</b><br/>Onsite access point surveys of recreational fishing are carried out to provide time-series of information on catch rates and the size structure of a range of fish species, including snapper.</p> <p><b>Volunteer general angler diary program (RAD)</b><br/>A voluntary general angler diary program was established in 1997 provides time-series data on recreational angler catch rates, and the size/age composition of key target species.</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                              |
| <b>Length and age monitoring</b>      | <p>Since the 1990s there has been routine sampling of length and age frequency distributions of snapper landed by commercial and recreational fishers. Otoliths used for snapper ageing are prepared and aged following standard procedures outlined in Morison <i>et al.</i> (1998).</p>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                 |

# Assessment indicators and status

The snapper fisheries east and west of Wilson's Promontory in Victoria are based on separate snapper stocks and are treated as separate management units.



The following 'traffic light' classification system has been developed to classify the status of individual snapper stocks.

| Stock status classification                                                         | Description                                                                                                                                                                                              | Trend in five-year moving average* | Is the most recent year above the long-term average** |
|-------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|------------------------------------|-------------------------------------------------------|
|  | The indicator suggests that the stock is in good condition. Current management arrangements are considered appropriate.                                                                                  | ↕↔                                 | Yes                                                   |
|  | The indicator suggests that the stock is improving. Current management arrangements are considered appropriate.                                                                                          | ↑                                  | No                                                    |
|  | The indicator suggests that the stock is decreasing. Current management arrangements may need to be assessed. Where appropriate, management responses to promote stock recovery need to be investigated. | ↓                                  | Yes/No                                                |
|  | The status of the stock is considered poor. Current management arrangements need to be assessed. Management responses to promote stock recovery need to be investigated.                                 | ↓                                  | No                                                    |
|  | There is a need to closely monitor this indicator. Current management arrangements may need to be assessed.                                                                                              |                                    |                                                       |
|  | A limited amount of information has been collected; or, there are inconsistent or contradictory signals in the data that preclude determination of stock status.                                         |                                    |                                                       |

\* Trend refers to a significant ( $P < 0.1$ ) linear change (ordinary least-squares regression model) in the five-year moving average of an indicator over the past 5 years; non-significant trends were considered stable. Analysis of residuals was carried out to determine whether statistical assumptions were met.

\*\* Long-term refers to the duration of the time-series.

**Table 1. Stock status determination using catch rate indicators of Victoria's western snapper stock. The data to support the following classifications are presented in Appendix I.**

| Source                         | Location         | Indicator                                                                                                                | Minimum                        | Maximum                        | Ten-year average               | Five-year average              | Most recent                                    | Trend in five-year moving average | Above long-term average     | Status                                                                                                  |
|--------------------------------|------------------|--------------------------------------------------------------------------------------------------------------------------|--------------------------------|--------------------------------|--------------------------------|--------------------------------|------------------------------------------------|-----------------------------------|-----------------------------|---------------------------------------------------------------------------------------------------------|
| Fishery-independent            | Port Phillip Bay | Beam-trawl catch rate (mean number/1000m <sup>2</sup> ) of 0+ snapper (across all sites), 11-year time-series (Figure 2) | 0.02                           | 15.16                          | 3.37                           | 1.37                           | 2010/11: 0.23                                  | ↓                                 | No                          | Decreasing<br>       |
|                                |                  | Multi-species otter-board trawl catch rate (mean number/5 min tow) of 1+ snapper, 17 year time-series (Figure 2)         | 0.00                           | 143.64                         | 42.34                          | 22.17                          | 2009/10: 61.89                                 | ↓                                 | Yes                         | Decreasing<br>       |
|                                |                  | RAD program catch rate (fish/angler hour) of 1+ snapper, 13-year time-series (Figure 2)                                  | 0.00                           | 3.39                           | 0.98                           | 0.68                           | 1.00                                           | ↓                                 | No                          | Decreasing<br>       |
|                                |                  | RAD program catch rate (fish/angler hour) 3-year time-series (Figure 4)                                                  | Oct-Dec: 0.93<br>Jan-Apr: 1.31 | Oct-Dec: 1.28<br>Jan-Apr: 3.22 | N/A                            | N/A                            | Oct-Dec 2009/10: 1.28<br>Jan-Apr 2010/11: 3.22 | N/A                               | Yes                         | Good condition                                                                                          |
| Commercial fishery-dependent   | Port Phillip Bay | Long-line catch rate (kg/200 hook-lifts) 30-year time-series (Figure 5)                                                  | 21                             | 76                             | 54                             | 67                             | 2009/10: 76                                    | ↑                                 | Yes                         | Good condition                                                                                          |
|                                |                  | Haul-seine catch rate (kg/shot) 30-year time-series (Figure 6)                                                           | <1                             | 14                             | 10                             | 11                             | 2009/10: 9                                     | ↓                                 | Yes                         | Good condition <sup>†</sup>                                                                             |
|                                | Western Port     | Catch rate (kg/day) 30-year time-series (all gear-types) (Figure 7)                                                      | 0.02                           | 6                              | 1                              | 2                              | 2009/10: 6                                     | ↑                                 | Yes                         | Limited data                                                                                            |
|                                | Oceanic waters   | Commonwealth catch (tonnes/year) 13-year time-series (Figure 8)                                                          | 0.5                            | 89.5                           | 42.1                           | 76.6                           | 2009: 85                                       | ↑                                 | Yes                         | Good condition<br> |
| Recreational fishery-dependent | Port Phillip Bay | GAD program catch rate (fish/angler hour) 13-year time-series (Figure 3)                                                 | 0.93                           | 3.61                           | 1.60                           | 1.68                           | 2010: 2.88                                     | ↔                                 | Yes                         | Good condition                                                                                          |
|                                |                  | Onsite survey retained catch rate (fish/angler hour) eight-year time-series (Figure 9)                                   | Oct-Dec: 0.21<br>Jan-Apr: 0.19 | Oct-Dec: 0.26<br>Jan-Apr: 0.29 | N/A                            | Oct-Dec: 0.23<br>Jan-Apr: 0.26 | Oct-Dec 2009/10: 0.25<br>Jan-Apr 2010/11: 0.26 | ↔                                 | Yes                         | Good condition                                                                                          |
|                                | Western Port     | Retained catch rate (fish/angler hour) 13-year time-series from onsite surveys (Figure 10)                               | Oct-Dec: 0.08<br>Jan-Apr: 0.08 | Oct-Dec: 0.35<br>Jan-Apr: 0.36 | Oct-Dec: 0.21<br>Jan-Apr: 0.25 | Oct-Dec: 0.27<br>Jan-Apr: 0.25 | Oct-Dec 2009/10: 0.25<br>Jan-Apr 2010/11: 0.21 | ↔                                 | Oct-Dec: Yes<br>Jan-Apr: No | Good condition <sup>††</sup>                                                                            |
|                                |                  | GAD program catch rate (fish/angler hour) 13-year time-series (Figure 3)                                                 | 0.16                           | 0.48                           | 0.29                           | 0.29                           | 2010: 0.18                                     | ↓                                 | No                          | Limited data                                                                                            |
|                                | Oceanic waters   | GAD program catch rate (fish/angler hour) 13-year time-series (Figure 3)                                                 | 0.10                           | 1.56                           | 0.38                           | 0.30                           | 2010: 0.10                                     | ↓                                 | No                          | Limited data                                                                                            |

<sup>†</sup> Despite a significant negative trend observed in the five-year moving average, the indicator is well above the long-term average; there is no clear indication that the stock is decreasing.

<sup>††</sup> Despite being below the long-term average, the indicator is stable; there is no clear indication that the stock is decreasing

**Table 2. Stock status determination using length and age indicators of Victoria's western snapper stock. The data to support the following classifications are presented in Appendix I.**

| Stock             |                                                                                                    | Western                                                                                                      |                                                                                                                |                                                                                                   |
|-------------------|----------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------------------------|
| Source            | Commercial Fishery                                                                                 | Recreational Fishery                                                                                         |                                                                                                                |                                                                                                   |
| Location          | Port Phillip Bay                                                                                   | Port Phillip Bay                                                                                             |                                                                                                                | Western Port                                                                                      |
| Indicator         | Long-line size (FL)/age (years)-frequency time-series (1994/95 to 2009/10) (Figure 11; Figure 12 ) | Onsite survey length (TL)/age (years)-frequency time-series (2003 to 2010) (Figure 13; Figure 14; Figure 15) | Research angler length (TL)/age (years)-frequency time-series (2008 to 2010) (Figure 16; Figure 17; Figure 18) | Onsite survey length (TL)-frequency time-series (2010) (Figure 19)                                |
| Minimum           | <b>2009/10:</b><br>34 cm/6 yrs                                                                     | <b>Oct-Dec 2010:</b><br>27 cm/1 yrs<br><b>Jan-Apr 2011:</b><br>20 cm/1 yrs                                   | <b>Oct-Dec 2010:</b><br>10 cm/0 yrs<br><b>Jan-Apr 2011:</b><br>9 cm/1 yrs                                      | <b>Oct-Dec 2010:</b><br>26 cm<br><b>Jan-Apr 2011:</b><br>25 cm                                    |
| Maximum           | 94 cm/32 yrs<br><br><b>2009/10:</b><br>77 cm/15 yrs                                                | Oct-Dec: 92 cm/24 yrs<br>Jan-Apr: 88 cm/25 yrs                                                               | Oct-Dec: 100 cm/27 yrs<br>Jan-Apr: 85 cm/15 yrs                                                                | Oct-Dec: 95 cm<br>Jan-Apr: 120 cm<br><br><b>Oct-Dec 2010:</b> 80 cm<br><b>Jan-Apr 2011:</b> 54 cm |
| Ten-year average  | 52 cm/9 yrs                                                                                        | N/A                                                                                                          | N/A                                                                                                            | Oct-Dec: 43 cm<br>Jan-Apr: 38cm                                                                   |
| Five-year average | 55 cm/10 yrs                                                                                       | Oct-Dec: 52 cm/7 yrs<br>Jan-Apr: 37 cm/5 yrs                                                                 | N/A                                                                                                            | Oct-Dec: 43 cm<br>Jan-Apr: 35 cm                                                                  |
| Most recent mean  | <b>2009/10:</b><br>59 cm/11 yrs                                                                    | <b>Oct-Dec 2010 mean:</b><br>53 cm/9 yrs<br><b>Jan-Apr 2011 mean:</b><br>38 cm/6 yrs                         | <b>Oct-Dec 2010:</b><br>46 cm/6 yrs<br><b>Jan-Apr 2011:</b><br>26 cm/3 yrs                                     | <b>Jan-Apr 2010:</b> 35 cm<br><b>Oct-Dec 2010:</b> 47 cm                                          |
| Most recent mode  | <b>2009/10:</b><br>61 cm/9 yrs                                                                     | <b>Oct-Dec 2010:</b><br>57 cm/9 yrs<br><b>Jan-Apr 2011:</b><br>34 cm/6 yrs                                   | <b>Oct-Dec 2010:</b><br>23 cm/9 yrs<br><b>Jan-Apr 2011:</b><br>25 cm/2 yrs                                     | <b>Jan-Apr 2010:</b> 35 cm<br><b>Oct-Dec 2010:</b> 44 cm                                          |
| Status            | Good Condition                                                                                     | Good Condition                                                                                               | Good Condition                                                                                                 | Good Condition                                                                                    |

Table 3. Stock status determination using catch rate indicators of Victoria's eastern snapper stock. The data to support the following classification are presented in Appendix I.

| Source                            | Commercial fishery-dependent                    |
|-----------------------------------|-------------------------------------------------|
| Indicator                         | Corner Inlet catch rate time-series (Figure 20) |
| Minimum                           | 0 kg/day                                        |
| Maximum                           | 6 kg/day                                        |
| Ten-year average                  | 1 kg/day                                        |
| Five-year average                 | 2 kg/day                                        |
| 2009/10                           | 1 kg/day                                        |
| Trend in five-year moving average | ↑                                               |
| Above long-term average           | No                                              |
| Status                            | Limited Data                                    |

**Table 4. Overall stock status classification matrix for snapper in Victorian waters.**

| Stock   | Source                                                                                         | Location                       | Indicator                                                        | Description of Current Status                                                                                                                                                                                                | Status Classification                                                           |
|---------|------------------------------------------------------------------------------------------------|--------------------------------|------------------------------------------------------------------|------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|---------------------------------------------------------------------------------|
| Western | Fishery-independent                                                                            | Port Phillip Bay               | Beam-trawl 0+ age catch rate (Figure 2)                          | Since the recruitment failure of the 2005/06 year class, recruitment of new year class has been moderate or low; catch rate of 0+ pre-recruits in 2010/11 were very low                                                      | Decreasing<br>↓                                                                 |
|         |                                                                                                |                                | Otter-board trawl 1+ age catch rate (Figure 2)                   | Catch rates of 1+ age pre-recruits have been moderate or low since 2005/06. The increased catch rate in 2010/11 is inconsistent with the decrease recorded for the 0+ pre-recruits in 2009/10                                | Decreasing<br>↓                                                                 |
|         |                                                                                                |                                | RAD program 1+ age catch rate (Figure 2)                         | Catch rates of 1+ age pre-recruits have been moderate or low since 2005/06. The increased catch rate in 2010/11 is inconsistent with the decrease recorded for the 0+ pre-recruits in 2009/10                                | Decreasing<br>↓                                                                 |
|         |                                                                                                |                                | RAD program catch rate (Figure 4)                                | Recreational catch rates have been increasing since 2008                                                                                                                                                                     | Good Condition                                                                  |
|         | Commercial fishery-dependent                                                                   | Port Phillip Bay               | Commercial long-line catch rate (Figure 5)                       | Long-line catch rates have been stable since 2005/06, with a notable increase in 2009/10                                                                                                                                     | Good Condition                                                                  |
|         |                                                                                                |                                | Commercial haul seine catch rate (Figure 6)                      | Haul seine catch rates increased from 2005/06 until 2007/08, and have since fluctuated. Catch rates are well above the long-term average                                                                                     | Good Condition                                                                  |
|         |                                                                                                |                                | Commercial long-line age-frequency distributions (Figure 12)     | The 2000/01 year class is currently dominating the commercial fishery. It is expected that the strong 2000/01 and 2003/04 year classes, and the moderate 2004/05 year class will support the fishery over the next few years | Good Condition                                                                  |
|         |                                                                                                | Oceanic waters                 | Commercial Commonwealth catch (Figure 7, Figure 8)               | Significant commercial catches of snapper (65-90 tonnes annually) were harvested between 2007 and 2010; annual reported prior to 2004 were <10 tonnes                                                                        | Good Condition<br>▶                                                             |
|         |                                                                                                | Recreational-fishery dependent | Port Phillip Bay                                                 | GAD program catch rate (Figure 3)                                                                                                                                                                                            | Catch rates have been increasing since 2008 and are above the long-term average |
|         | Recreational onsite survey retained catch rate (Figure 9)                                      |                                |                                                                  | Catch rates are stable and above the long-term average                                                                                                                                                                       | Good Condition                                                                  |
|         | Recreational onsite survey and angler diary age-frequency distributions (Figure 15; Figure 18) |                                |                                                                  | The 2000/01, 2003/04 and 2004/05 year classes are dominating the recreational fishery. It is expected that the 2003/04 and 2004/05 year classes will support the fishery over the next few years                             | Good Condition                                                                  |
|         | Western Port                                                                                   |                                | Recreational retained catch rate from onsite surveys (Figure 10) | Recreational catch rates are stable                                                                                                                                                                                          | Good Condition                                                                  |
| Eastern |                                                                                                |                                |                                                                  | There are no indicators available for specifically assessing the status of Victoria's eastern snapper stock                                                                                                                  | Limited Data                                                                    |

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Karina Ryan produced programs for routine reporting of data.

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Thank you to Pam Oliveiro, Katrina Halse, Tina, Whillock and Pieta Lindberg for data editing and entry.

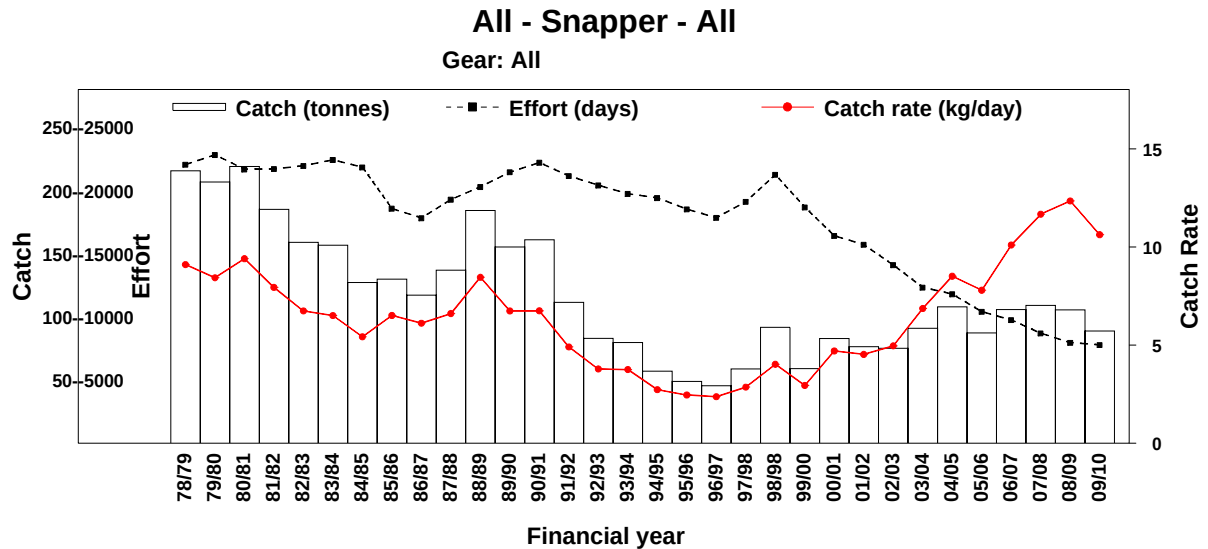
Thankyou to the our field staff for their many hours interviewing anglers during onsite access point surveys

Thank you to recreational angler diarists who generously return records of their snapper fishing for analysis. Thank you to Jon Presser, James Andrews and Leanne Gunthorpe for comments on this report.

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# Appendix I: Data figures and tables



Prepared by the Fisheries Research Branch, Fisheries Victoria (October 2010)

Figure 1. Annual commercial catch (tonnes) and catch rate (kg/day) of snapper, and effort (days) targeting both snapper and other species in Victoria from 1978/79 to 2009/10, presented by financial year.

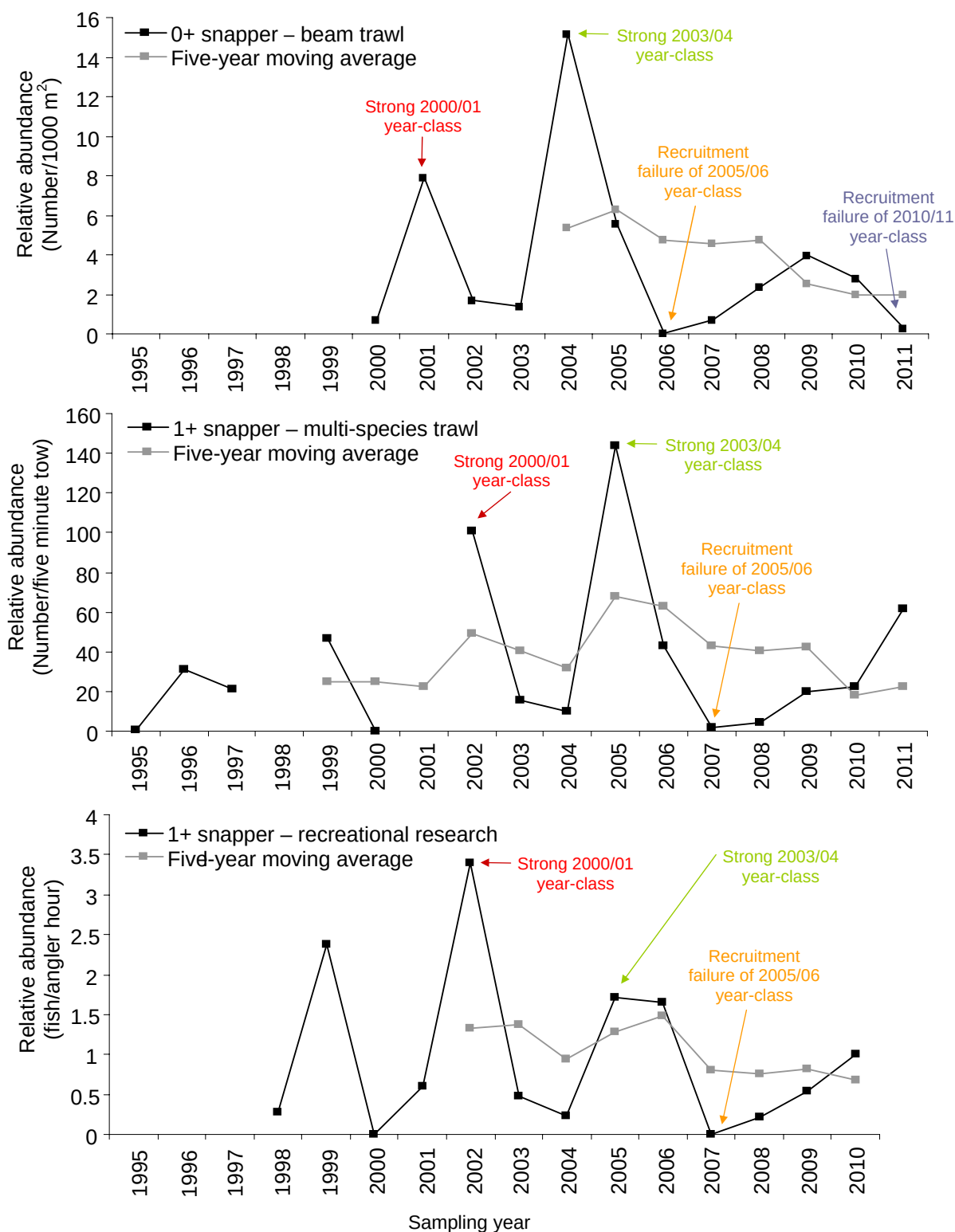


Figure 2. The relative abundance of a) 0+ snapper taken by fisheries-independent snapper beam trawl survey; b) 1+ snapper taken by fisheries-independent multi-species trawl survey; and, c) 1+ snapper taken by a recreational research angler from the angler diary program.

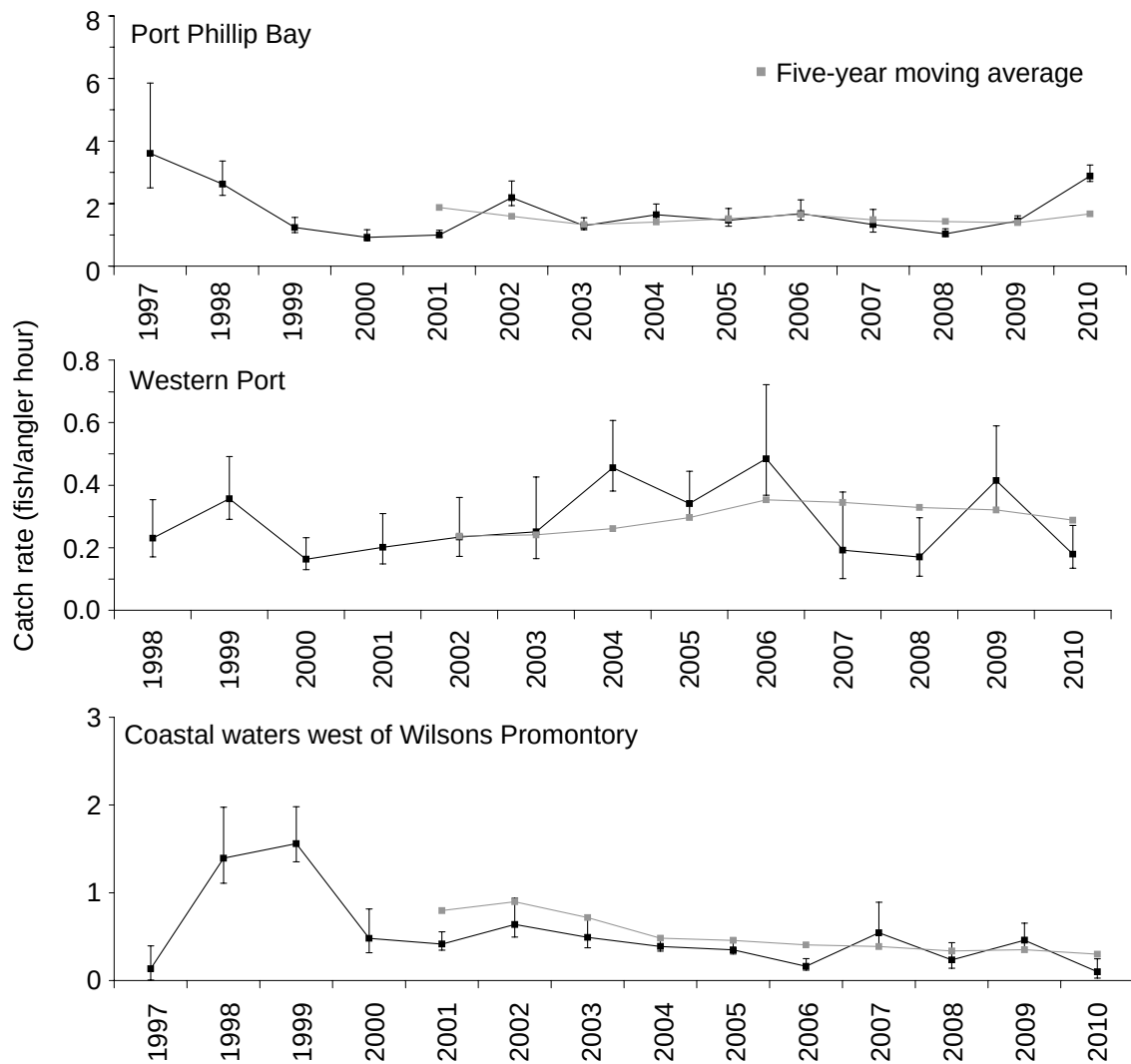


Figure 3. Average annual recreational targeted catch rates (fish/angler hour  $\pm$  standard error) of snapper taken by general angler diarists in Port Phillip Bay, Western Port, and the coastal waters west of Wilsons Promontory.

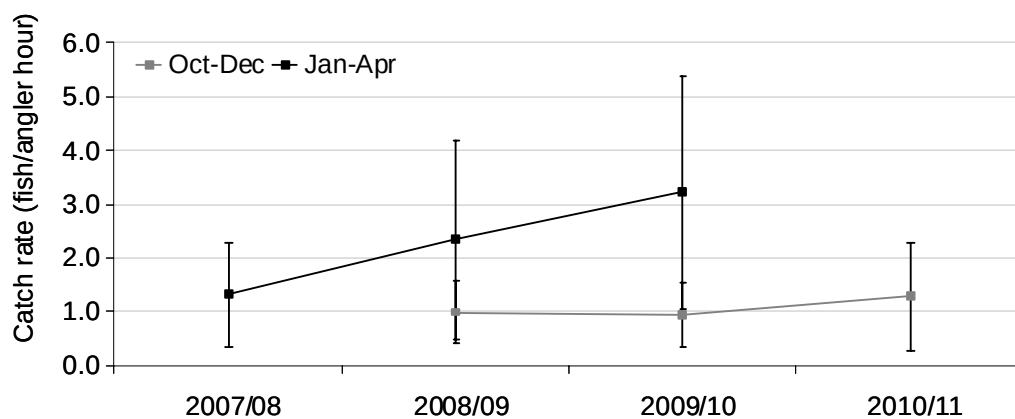
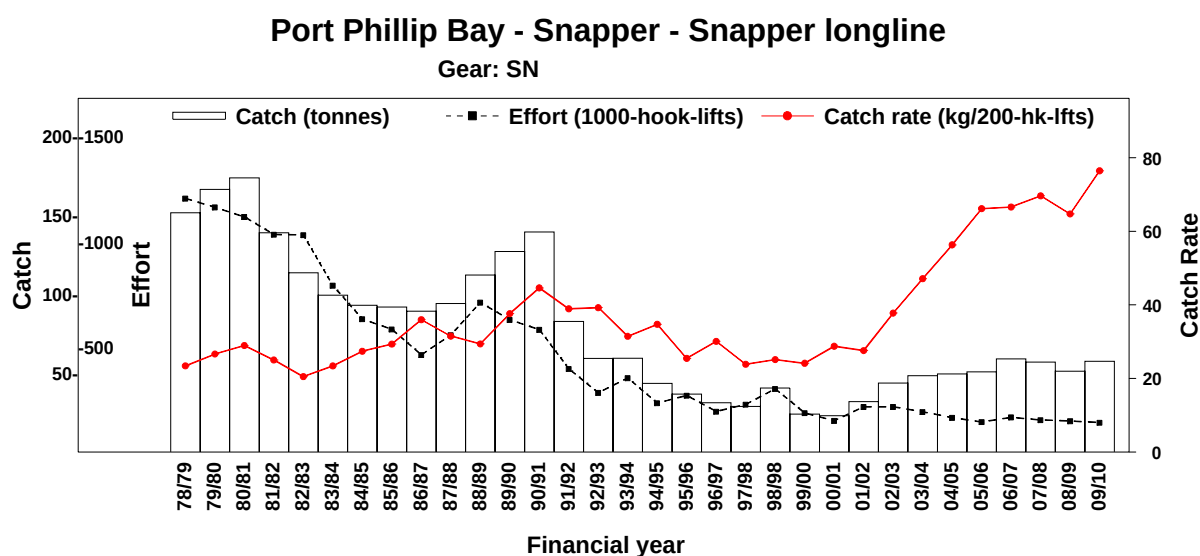
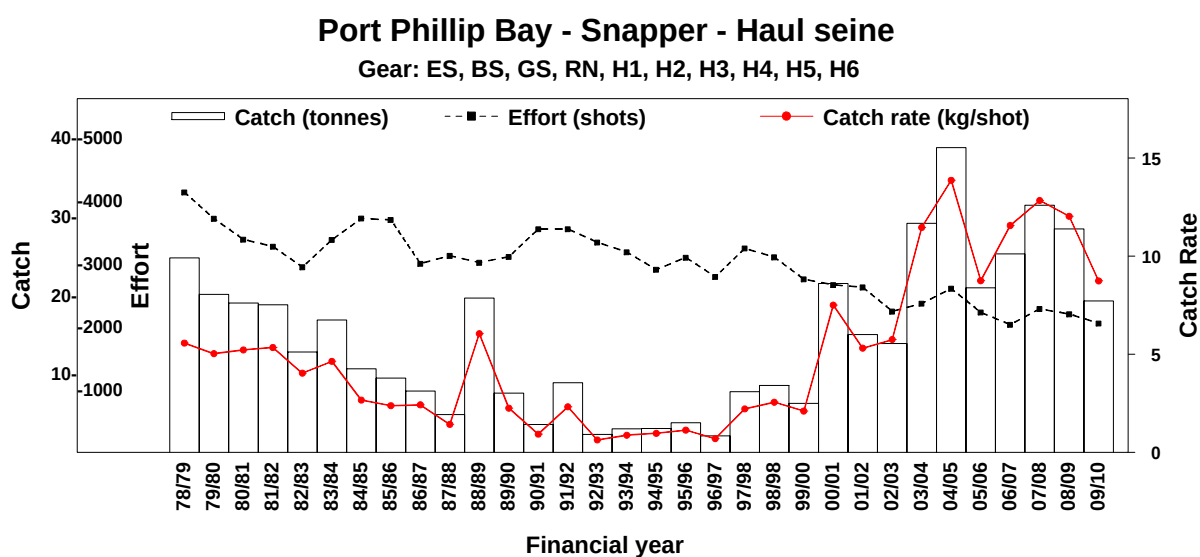


Figure 4. Average annual recreational targeted catch rates (fish/angler hour  $\pm$  standard error) of snapper taken by research angler diarists in Port Phillip Bay in October to December and January to April, from 2007/08 to 2010/11.



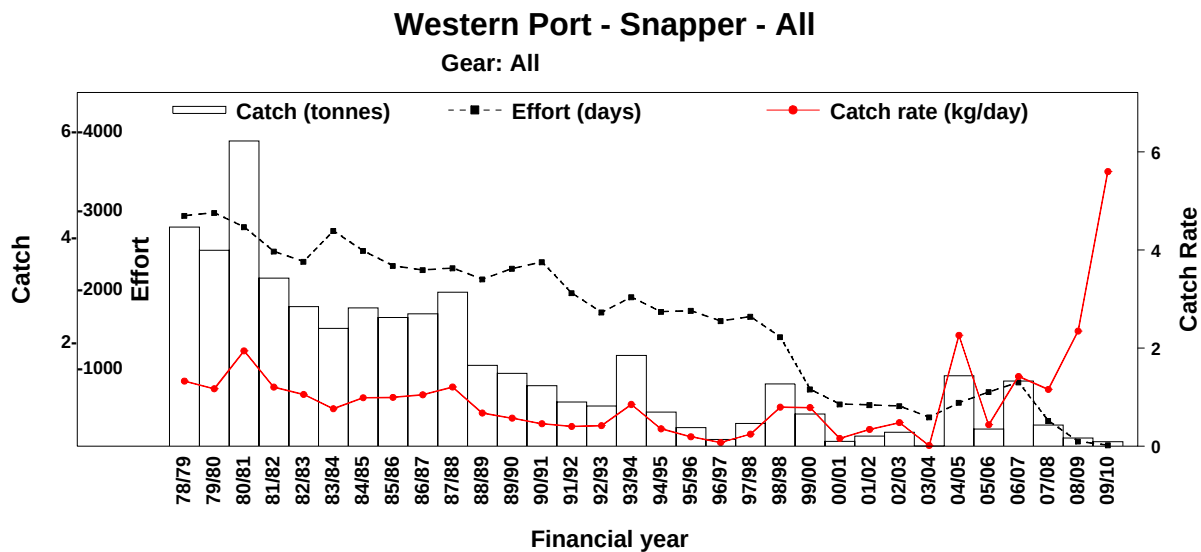
Prepared by the Fisheries Research Branch, Fisheries Victoria (October 2010)

Figure 5. Snapper long-line annual commercial catch (tonnes) and catch rate (kg/200-hook-lifts) of snapper, and effort (shots) targeting both snapper and other species in Port Phillip Bay from 1978/79 to 2009/10, presented by financial year.



Prepared by the Fisheries Research Branch, Fisheries Victoria (October 2010)

Figure 6. Haul seine annual commercial catch (tonnes) and catch rate (kg/shot) of snapper, and effort (shots) targeting both snapper and other species in Port Phillip Bay from 1978/79 to 2009/10, presented by financial year.



Prepared by the Fisheries Research Branch, Fisheries Victoria (October 2010)

Figure 7. Annual commercial catch (tonnes) and catch rate (kg/day) of snapper, and effort (days) targeting both snapper and other species in Western Port from 1978/79 to 2009/10, all gear types, presented by financial year.

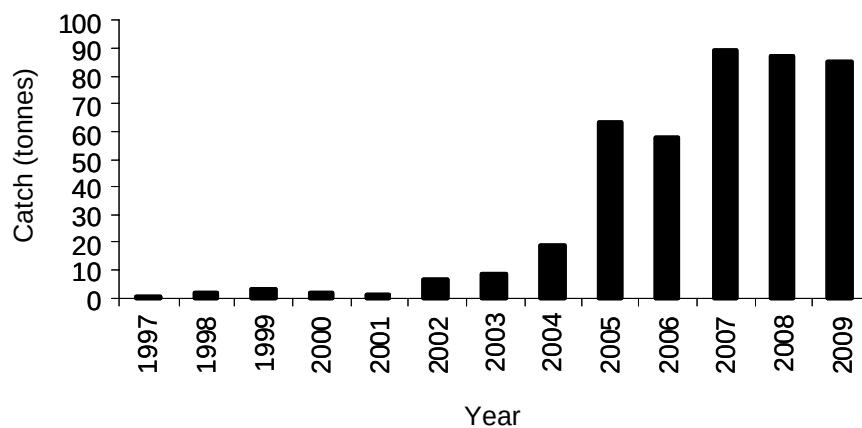


Figure 8. Annual commercial catch (tonnes) of snapper taken from Commonwealth waters adjacent to Victoria from 1997 to 2009, presented by calendar year.

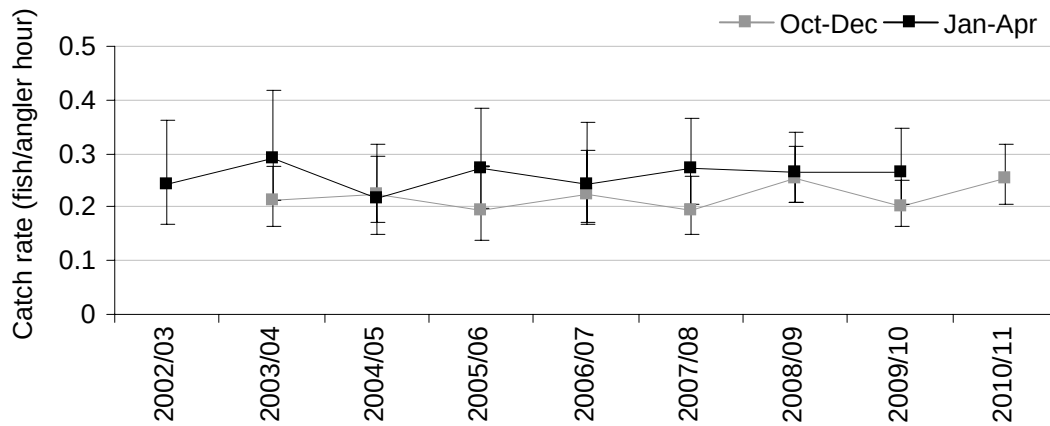


Figure 9. Average annual recreational targeted retained catch rates from October to December and January to April (fish/angler hour  $\pm$  standard error) of snapper taken by avid anglers in Port Phillip Bay from onsite access point surveys.

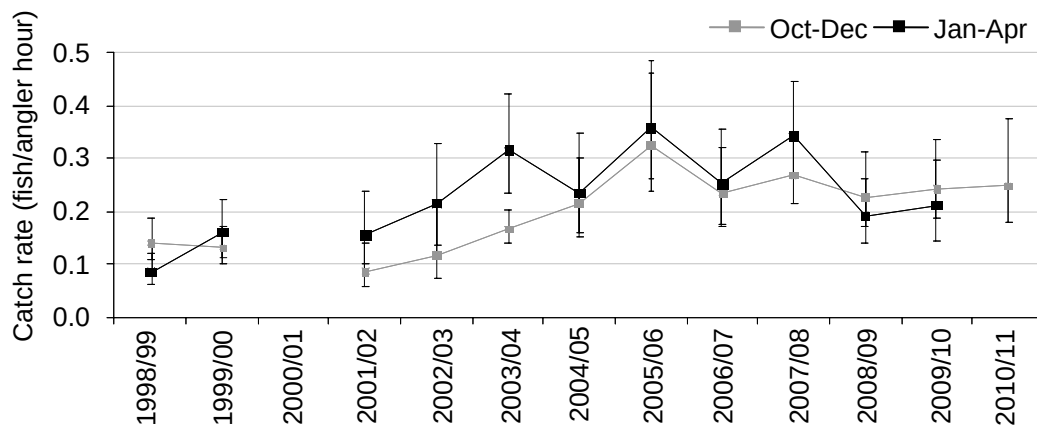
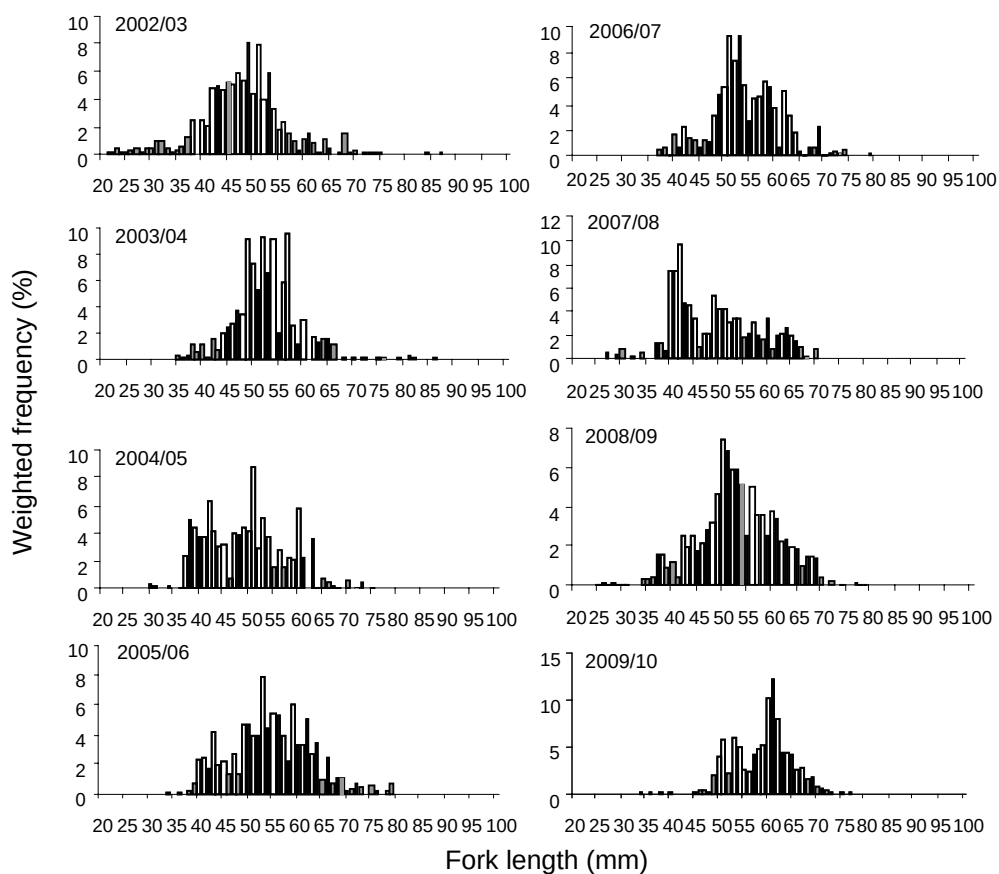


Figure 10. Average annual recreational targeted retained catch rates from October to December and January to April (fish/angler hour  $\pm$  standard error) of snapper taken by avid anglers in Western Port from onsite access point surveys.



**Figure 11. Length frequency distributions of snapper taken by commercial long-lines in Port Phillip Bay from 2002/03 to 2009/10.**

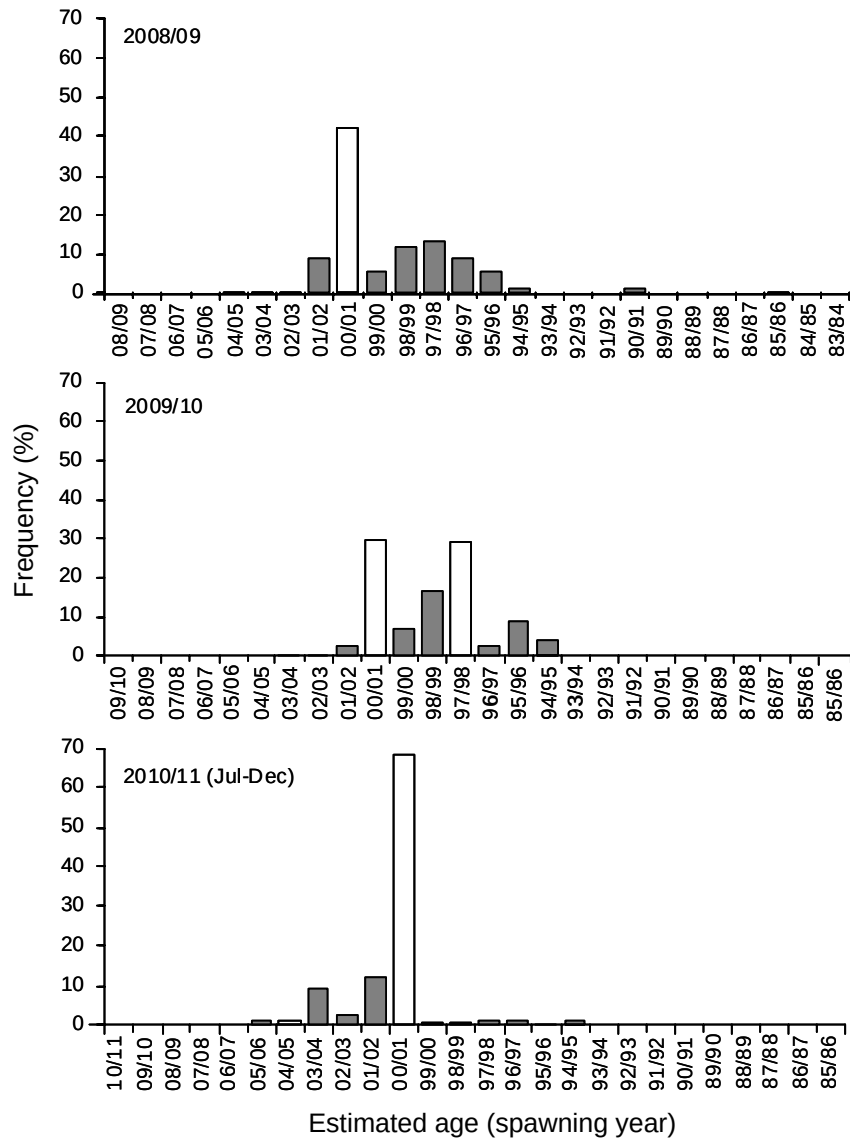
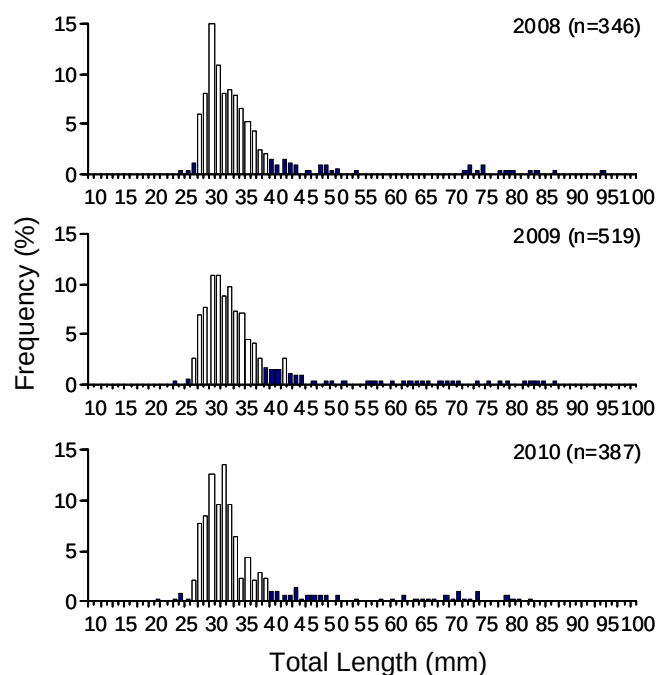
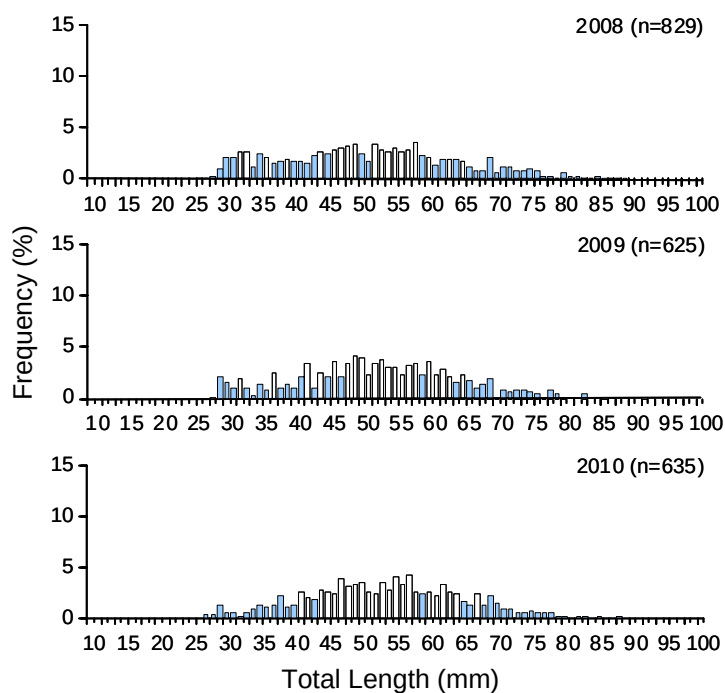


Figure 12. Age frequency distribution of snapper taken by commercial long-lines in Port Phillip Bay from 2008/09 to 2010/11.



**Figure 13. Length frequency distributions of snapper from recreational onsite access point surveys from January to April, 2008 to 2010, in Port Phillip Bay.**



**Figure 14. Length frequency distributions of snapper from recreational onsite access point surveys from October to December, 2008 to 2010, in Port Phillip Bay.**

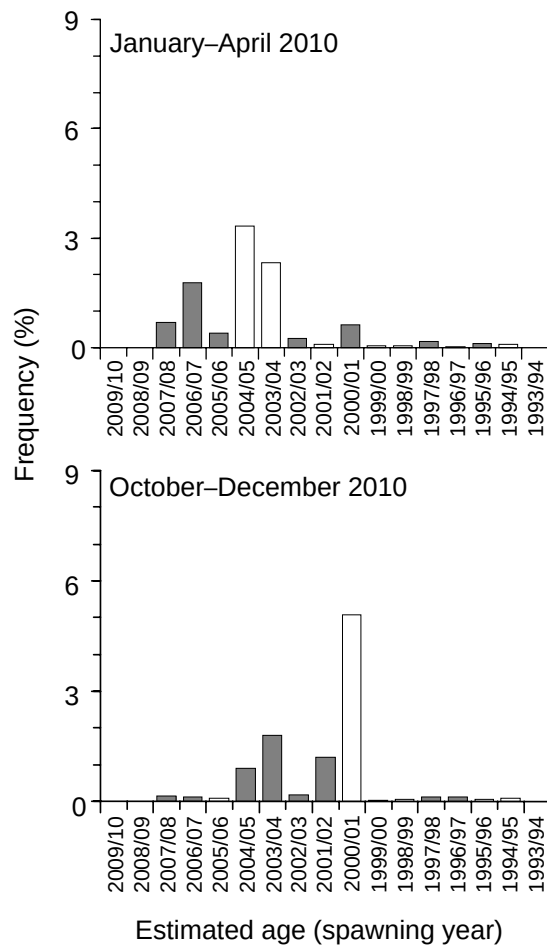
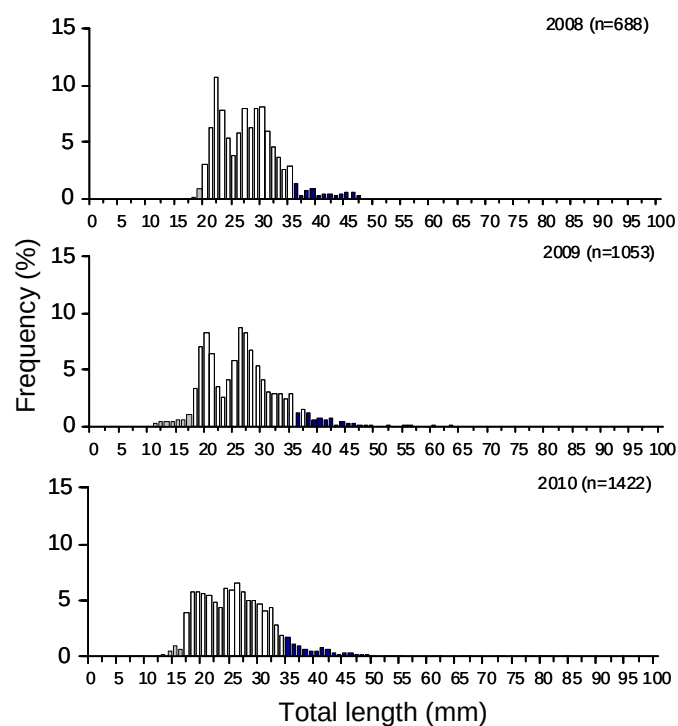
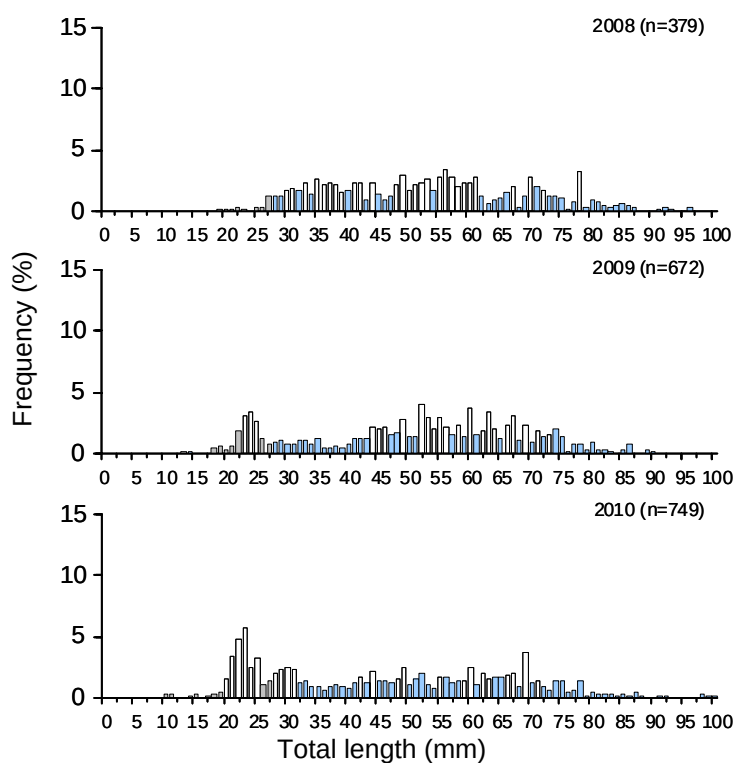


Figure 15. Age-frequency distributions from recreational onsite surveys for January to April and October to December 2010 in Port Phillip Bay.



**Figure 16. Length frequency distributions of snapper taken by recreational research anglers from January to April, 2008 to 2010, in Port Phillip Bay.**



**Figure 17. Length frequency distributions of snapper taken by recreational research anglers from October to December, 2008 to 2010, in Port Phillip Bay.**

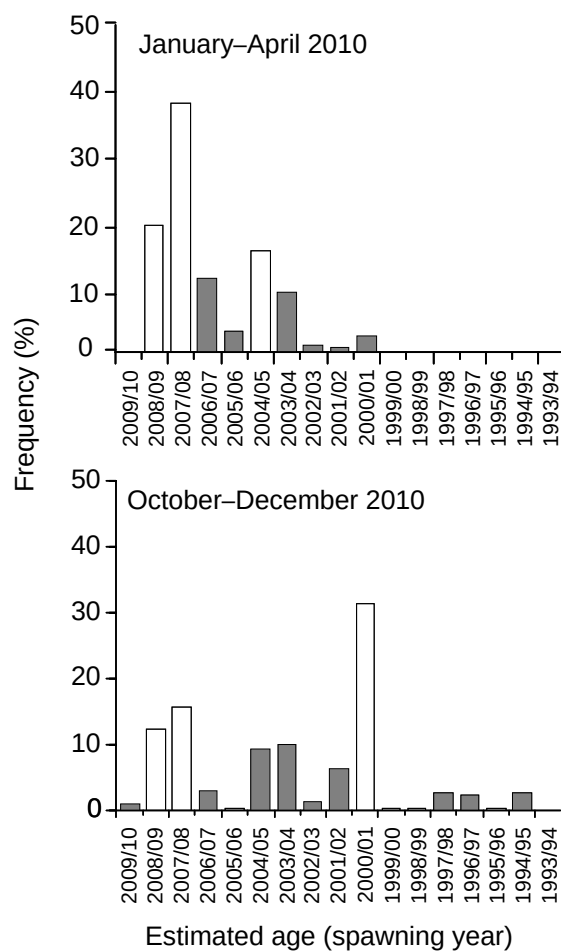


Figure 18. Age-frequency distributions of snapper taken by research anglers for January to April and October to December 2010 in Port Phillip Bay.

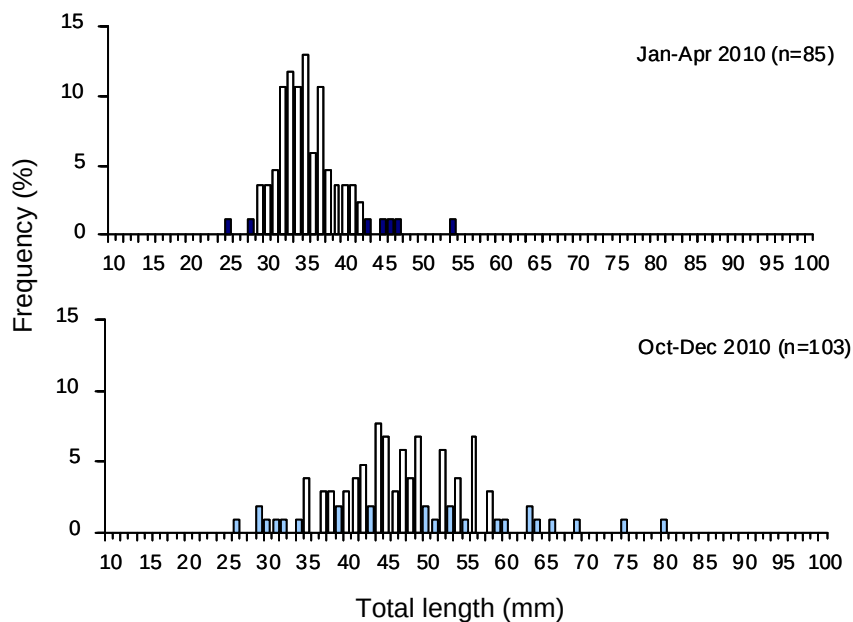
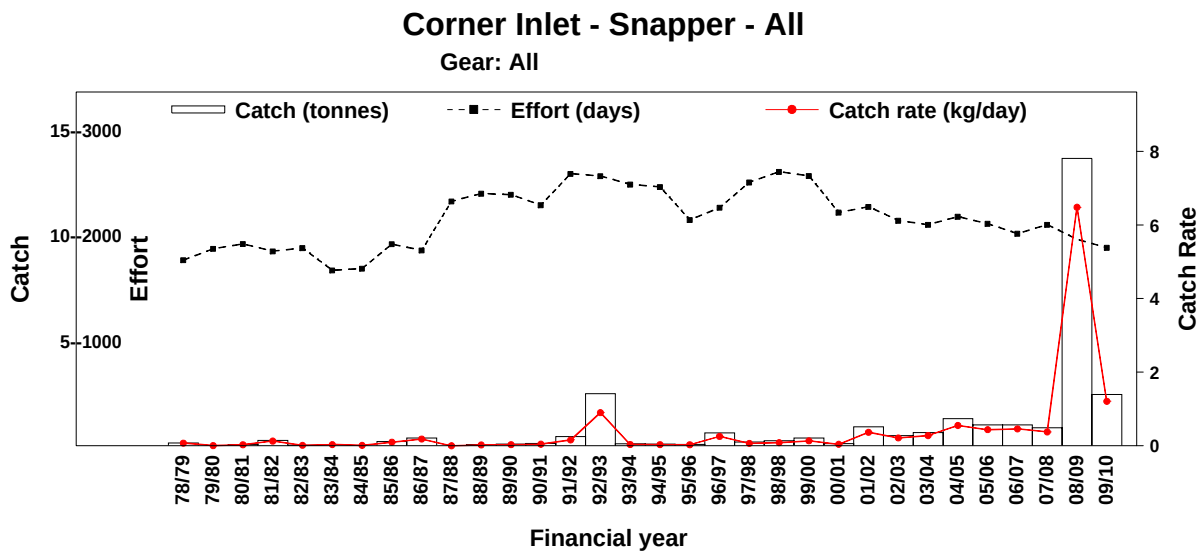
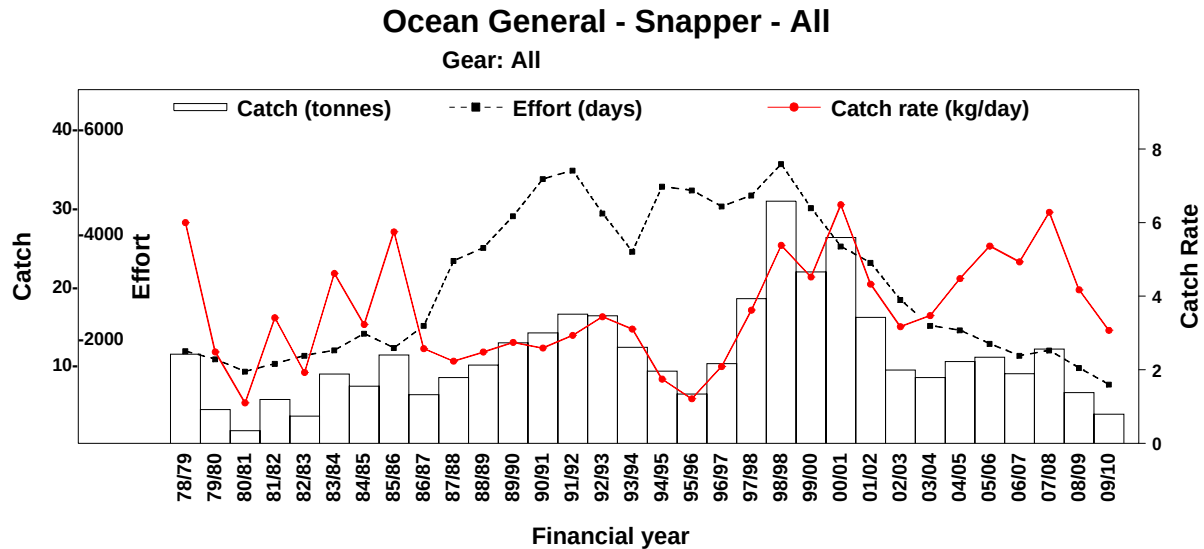


Figure 19. Length frequency distributions of snapper from recreational onsite access point surveys from January-April and October-December 2010 in Western Port.



Prepared by the Fisheries Research Branch, Fisheries Victoria (October 2010)

Figure 20. Annual commercial catch (tonnes) and catch rate (kg/day) of snapper, and effort (days) targeting both snapper and other species in Corner Inlet from 1978/79 to 2009/10, all gear types, presented by financial year.

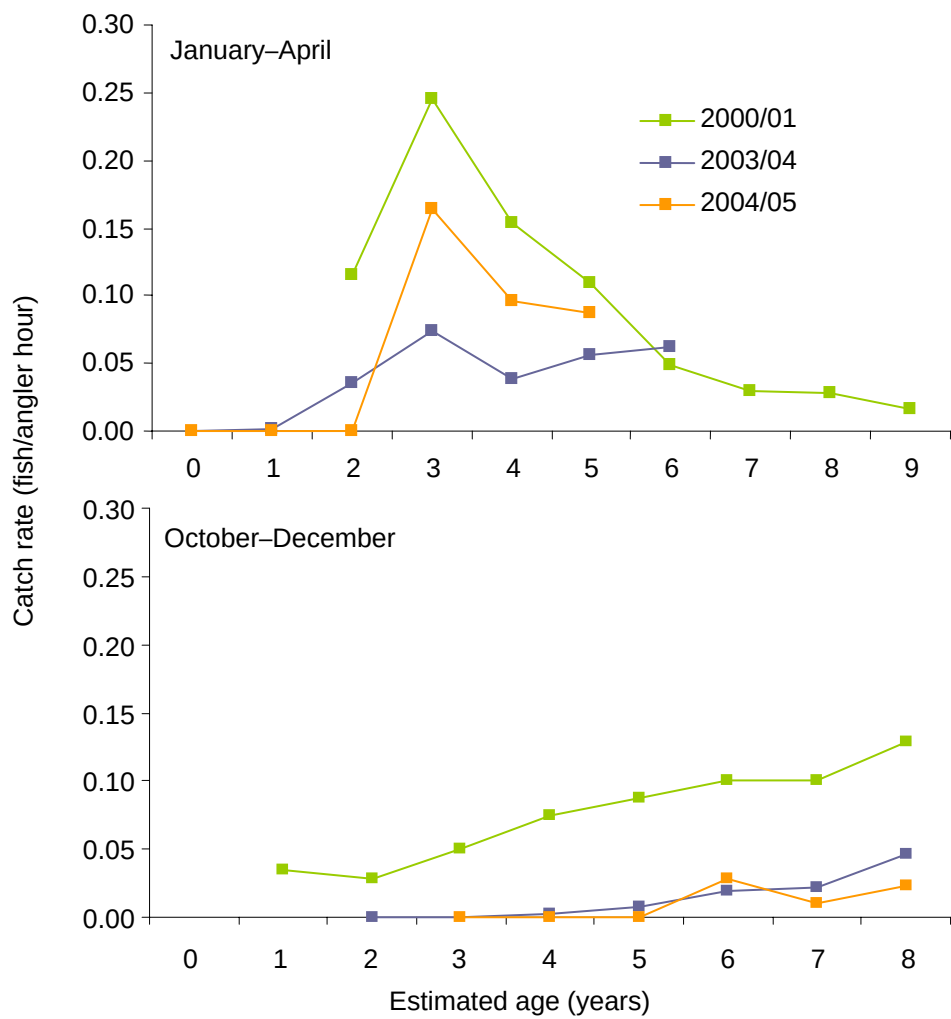


Prepared by the Fisheries Research Branch, Fisheries Victoria (October 2010)

**Figure 21. Annual commercial catch (tonnes) and catch rate (kg/day) of snapper, and effort (days) targeting both snapper and other species in the coastal waters of Victoria from 1978/79 to 2009/10, all gear types, presented by financial year.**

**Table 5. Summary of the commercial catch of snapper and effort targeting snapper and other species in Victorian bays and inlets.**

| Stock           | Western          |                          |                |                |                         |               | Eastern                 |               |
|-----------------|------------------|--------------------------|----------------|----------------|-------------------------|---------------|-------------------------|---------------|
| Location        | Port Phillip Bay |                          |                |                | Western Port            |               | Corner Inlet            |               |
| Fishing method  | Long-line        |                          | Haul seine     |                | All gear types combined |               | All gear types combined |               |
| Variable        | Catch (tonnes)   | Effort (1000 hook-lifts) | Catch (tonnes) | Effort (shots) | Catch (tonnes)          | Effort (days) | Catch (tonnes)          | Effort (days) |
| 10 year average | 47               | 181                      | 24             | 2490           | 0.4                     | 470           | 2                       | 2251          |
| 5 year average  | 55               | 161                      | 24             | 2307           | 0.4                     | 406           | 4                       | 2161          |
| 2009/10         | 57               | 150                      | 38             | 2194           | 0.08                    | 15            | 2                       | 2019          |
| Trend           | ↑                | ↓                        | ↑              | ↓              | ↓                       | ↓             | ↔                       | ↓             |



**Figure 22. Age-specific catch rates of spawning year classes from recreational onsite surveys for January to April and October to December in Port Phillip Bay.**

# Appendix II: 2011 Workshop participant perspectives

- Commercial fishers operating in Victorian coastal waters reported that snapper catches had been good in recent years and were increasing.
- Recreational fishers reported 'exceptionally' good catches of snapper in Port Phillip Bay in recent years, and that catch rates in Western Port had been stable.
- Recreational fishers reported that 'pinkies' were abundant inshore and around artificial reefs in Port Phillip Bay.
- Recreational fishers reported that there had been a reduction in the size of snapper taken in Western Port, and that larger fish (>3 kg) were a less common occurrence than in previous years.
- Fisheries officers reported evidence of increased non-compliance and concealment, and that this was likely due to the current high abundance of snapper.

# Appendix III: Previous assessments

## Snapper stock assessment 2002

- High levels of snapper recruitment were noted.
- Catch rates in the commercial and recreational sectors were reported as stable or increasing.
- Long-line catches in Port Phillip Bay declined to the lowest on record in 2000/01 (23 tonnes); this was partly the result of a reduction in effort due to a voluntary licence buy-back schemes conducted in 1999/00.

## Stakeholder perspectives

- Commercial fishers reported that there was a reasonable number of large snapper in Port Phillip Bay during 2001/02.
- Haul seine commercial fishers reported a high abundance of small snapper in Port Phillip Bay.
- Concern for post release survival of undersize fish was expressed.
- Western Port recreational fishers reported that snapper catch rates had declined over the last decade, but that catch rates were improving.

## Snapper stock assessment 2008

- Commercial long-line and haul seine catch rates in Port Phillip Bay were reported as stable.
- The proportion of larger ( $\geq 65$  cm FL) older ( $\geq 14$  years) snapper taken by commercial fishers had declined.
- A reduction in the abundance of small snapper in Port Phillip Bay and Western Port had resulted in lower release rates.
- Release rates of pinky snapper in Port Phillip Bay were high when recreational fishers were targeting King George whiting.
- Research into the post release survival of snapper indicated that if fish were shallow-hooked (in the lip) there was high post release survival (97.5%). However, deep-hooked fish had a low post release survival (48.4%). Survival of deep hooked fish was higher if the hook was not removed.
- Angler diary and onsite survey data collected from fishers targeting King George whiting showed that 92% of snapper taken

were shallow-hooked and 8% were deep-hooked.

- In 2006, the minimum legal size for snapper was increased from 27 to 28 cm TL; the daily bag limit remained at 10, however, a maximum of three snapper measuring 40 cm TL or more was introduced to replace the previous allowance of three fish measuring 50 cm TL or more was introduced. These changes were implemented in response to stakeholder feedback on a discussion paper of options for changes in snapper size and bag limits, and were not driven by management decisions to constrain mortality.
- A further voluntary commercial licence buy-back scheme was conducted in 2005/06.

## Stakeholder perspectives

- Haul seine commercial fishers reported low catches of snapper in Port Phillip Bay; juveniles, and adults  $>1$  kg, were rarely being taken.
- Recreational fishers reported a decrease in the amount of small fish landed in the Patterson River from  $\sim 30$ –40 fish to  $\sim 10$  fish, and that release rates were high.
- Recreational fishers reported that they were rarely reaching the daily bag limit, and that the abundance of pinkies in Port Phillip Bay was low; one recreational fisher reported that pinkies were abundant near Black Rock.
- More anglers reported using soft plastics and lures to target snapper.

The 2002 and 2008 snapper stock assessment workshops showed there was no evidence in the available indicators for a review of snapper management arrangements, and that the current level of protection should be maintained.

# Appendix IV: Snapper life-history information

|                        |                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                          |
|------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| <b>Distribution</b>    | <ul style="list-style-type: none"> <li>Northern Queensland to Carnarvon in Western Australia including Tasmania, and around New Zealand.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                      |
| <b>Stock structure</b> | <ul style="list-style-type: none"> <li>The snapper fisheries east and west of Wilsons Promontory in Victoria are based on separate snapper stocks and are treated as separate management units</li> <li>The snapper east of Wilson's promontory though to be part of a larger widely dispersed snapper stock distributed from eastern Victoria to southern Queensland</li> <li>Victorian commercial catches are predominantly from the western stock</li> <li>Port Phillip Bay is an important snapper spawning and nursery area for Victoria's western snapper stock; the majority of adults recruiting to Port Phillip Bay, Western Port and coastal waters in western Victoria are the product of localised spawning and juvenile recruitment in Port Phillip Bay.</li> </ul>                                                                                                                                                                                                                                                                                         |
| <b>Movement</b>        | <ul style="list-style-type: none"> <li>After a pelagic larval phase (20–25 days), snapper settle to bottom habitats in sheltered bays and estuaries</li> <li>Juveniles mostly remain in sheltered waters for at least their first year of life, but beyond this age they can display a variety of movement behaviours, ranging from local residency to movements of 100's km in coastal waters</li> <li>Adult snapper make mass migrations into Port Phillip Bay from coastal waters each spring-summer to breed, and most are thought to leave the bay by autumn. However, long-term residency of adult snapper in Port Phillip Bay and coastal waters is also thought to occur.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                             |
| <b>Habitats</b>        | <ul style="list-style-type: none"> <li>Juvenile and adult snapper are demersal (i.e. occurring mostly near the bottom)</li> <li>Small juveniles (&lt; 1 year old, &lt; 20 cm length) are most commonly associated with sediment habitats</li> <li>Older juveniles and adults can be associated with both reef and sediment habitats</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                           |
| <b>Longevity</b>       | <ul style="list-style-type: none"> <li>Up to 40 years of age</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                  |
| <b>Reproduction</b>    | <ul style="list-style-type: none"> <li>Small individuals &lt;35 cm TL (&lt;3 years of age) are mostly immature</li> <li>Snapper between 35 and 44 cm TL (~3–5 years of age) are mostly maturing</li> <li>Sexual maturity in Port Phillip Bay occurs at ~5years of age at ~42 cm TL (36 cm FL)</li> <li>Spawning occurs from late spring to summer (November–February) with a common peak in December/early January, and can occur in bays and coastal waters</li> <li>Adults move into bays, most notably, Port Phillip, and aggregate to spawn during late spring and summer (October–December) and return to coastal waters in late summer/autumn</li> <li>Snapper are serial batch spawners; which means that individual fish can spawn many times during the spawning season.</li> <li>Spawning is thought to occur in the evening (as per studies in South Australia)</li> <li>The number of eggs produced by adult snapper increase exponentially with size, with a large adult snapper capable of releasing millions of eggs during a spawning season.</li> </ul> |
| <b>Recruitment</b>     | <ul style="list-style-type: none"> <li>Spawning success as measured by the successful recruitment of juvenile snapper is highly variable from year to year</li> <li>This variation appears to be related to highly variable survival rates of larvae, which may be linked to environmental influences.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                        |
| <b>Growth</b>          | <ul style="list-style-type: none"> <li>Growth rates are similar in Port Phillip Bay, Western Port and Corner Inlet</li> <li>Most snapper at 40 cm TL are typically 4–6 years of age</li> <li>Individuals recruit to the commercial and recreational fisheries at 28 cm TL (the legal minimum length) and 2–3 years of age.</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                    |
| <b>Diet</b>            | <ul style="list-style-type: none"> <li>Snapper are considered generalist predators, and their diet varies with fish size</li> <li>Larvae feed on a range of tiny zooplankton and invertebrate eggs</li> <li>Small individuals (5–15 cm TL) feed mainly on polychaete worms and small crustaceans</li> <li>Individuals from 15–25 cm TL mostly consume crustaceans, molluscs and small fish</li> <li>Large individuals consume crustaceans, molluscs, cephalopods (i.e. squid and octopus) and fish</li> </ul>                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                                            |

References: Coutin *et al.* 2003; Hamer and Jenkins 2007; Gomon *et al.* 2008; Saunders 2009; Hamer *et al.* 2010; Hamer *et al.* 2011; Murphy *et al.* 2011 ;

# Appendix V: Data collection methods

This section further describes relevant research and monitoring used to provide information for the 2011 snapper stock assessment.

## Commercial fishery

Recording of commercial catches from bay and inlet fisheries commenced in 1914.

Catch information was recorded in this manner by calendar year until 1963.

Fishers provided more detailed monthly catch data to the Victorian Department of Fisheries and Game between 1964/65 and 1972/73. This catch information was forwarded to the Commonwealth Bureau of Census and Statistics for processing and reporting. Throughout this period, fishing effort data were not detailed and have not been summarised.

Between 1973/74 and 1977/78, the same type of data were recorded and collected but were processed and summarised by the Victorian Fisheries and Wildlife Division.

More detailed daily records of fishing method, area, catch and effort (and therefore catch rate) have been collected and entered into databases since 1978/79.

These data have been checked for major errors by a series of range tests and other validation routines that are part of the normal data entry procedures of the Catch and Effort Unit at the Department of Primary Industries, Queenscliff. A review of logbook data quality has indicated that more than 95% of monthly catch/effort returns have been submitted. There is potential for some errors in catch rate due to unrecorded effort and/or errors in coding effort data.

No attempt has been made to independently verify the accuracy of catch weight, fishing location or effort values supplied by fishers. Effort values are not standardised as no attempt has been made to make any adjustment for changes in fishing power over the period for which catch/effort statistics have been collected.

## Recreational fishery

There have been two large-scale, telephone-diary surveys of recreational fishing in Victoria aimed at estimating total recreational catch.

The National Recreational Fishing Survey in 2000/01 provided State-wide and regional estimates of both retained and discarded catches of key target species by recreational fishers (Henry and Lyle 2003). Anglers were identified and recruited for the survey using a State-wide telephone screening method.

State-wide and regional recreational catches of key Victorian marine and estuarine species were estimated again in 2006/07 using a telephone diary survey (Ryan *et al.* 2009). The 2006/07 survey used the Recreational Fishing Licence database as a sampling frame to identify and recruit anglers.

Data from onsite access point surveys provides a time-series of information on species targeted and caught by anglers, discard rates, catch rates and the length and age composition of the retained catch of key target species. Seasonal boat ramp access point surveys have been conducted every year since 2003. A variable number of interviews occur on any sample day. Avid anglers are anglers who recalled fishing at least five days in the previous 12 months. Calculating mean catch rates from these anglers increases consistency in the sampling effort and reliability of the analyses.

The access point angler survey covers a large number of anglers with sampling bias towards fine weather weekend days in order to maximise the number of interviews. Discard rates are potentially subject to recall bias. The precision of the annual and seasonal catch rate estimate is influenced by sampling intensity (survey days). Fork length measurements are made by trained interviewers.

Volunteer angler diarists have been operating in Victoria since 1997. Experienced volunteer anglers contributed to either the 'general' or 'research' angler diary program. All anglers recorded:

- Time spent fishing
- Fishing location
- Species targeted and caught
- Fish lengths
- Number of rods
- Bait and hook type/sizes used.

In addition, research anglers were required to alter their fishing techniques (hook sizes, baits

and fishing locations) in order to catch the largest possible size range of the key species they were targeting. All catches, including under-size fish, were recorded in diaries, and all fish caught were measured. Otolith samples were collected for ageing.

The general angler diary program requires anglers to record results from their 'normal' fishing activities and represents a completely fishery dependent method of collecting data.

The research angler diary program is also considered to be a fishery independent method, as anglers that participate are bound by prescribed gear (hook sizes), times and locations. The main advantage of the research angler diary program over the general angler diary program is the standardisation of effort, enabling a more rigorous assessment of trends over time.

These angler diary data are not representative of all anglers, but are collected in a consistent manner and are therefore comparable from year to year.

Average recreational catch rates were calculated using the ratio of the means estimator (Jones *et al.* 1995). This estimator allows for the fact that information obtained from interviews with recreational fishers represents complete trips. Confidence limits were estimated using bootstrapping methods (Efron and Tibshirani 1993).

# Appendix VI: Fishing methods

## Long-line

Long-lining involves a long length of fishing line, often several kilometers long, to which short lengths of line carrying baited hooks are attached. The long-lines are hauled up periodically.

The gear is often set on the bottom where it is held by anchors. The start and finish of the long-line is marked with buoys and flags. A long-line can also be set just below the surface where the target species is pelagic, or suspended at the required depth using regularly spaced buoys along the line.

In Victorian waters, long-lining is used to catch snapper, along with school shark, gummy shark and tuna.

## Haul seine

Haul seining involves the setting of a net, with long ropes at both ends from a boat. The nets travel a semicircular course. Both ropes and then ends of the net are winched in so that the area enclosed by the net continually decreases until it is small enough for the fish to be removed.

Under-sized and unwanted fish are then released. Fish are sorted before the net is removed from the water so that the by-catch of undersize or unwanted fish can be released back into the sea alive. The ropes are up to one kilometer long. There are floats on the rope and weights at the bottom so the net hangs vertically in the water.

In shallow, protected areas which have sandy substrate; long warps are often attached to the ends of the ropes to increase the area being encircled. Modifications to haul seine nets during the 2000s have enabled seine fishing to occur over hard substrates.

In Victorian waters, haul seining is used to catch snapper, King George whiting, flounder, bream, garfish, calamari and rock flathead. Small boats are commonly used with one or two fishers.