

**PILBARA FIGURE 4**

Spawning biomass (with 95% confidence intervals) as a percentage of the 1990 level (black line); the biological reference point (40% of the 1990 level – dashed line); and the catch from all fishing sectors (columns) for Rankin cod in the Pilbara fishery. Data from 2003 onwards is projected from the model.

## Mackerel Fishery

### Management Summary

Fishing for mackerel species, which is currently available to all Western Australian licensed commercial fishing boats, was reported by 78 boats during 2002. Although most of these catches were made opportunistically by boats operating within other fisheries, there are about 10 boats which specifically target mackerel.

Owing to concerns over increased catches and evidence to suggest that the species may be in danger of over-fishing, the Mackerel Independent Advisory Panel was appointed in 2001 to make recommendations to the Executive Director on criteria for access to, and management arrangements for, the mackerel fishery. Following extensive consultation, recommendations from the advisory panel and advice from the Department of Fisheries, the Minister for Fisheries has approved the drafting of the Mackerel Fishery (Interim) Management Plan, to commence in 2004.

The mackerel fishery (including all mackerel of the genera *Scomberomorus*, *Grammatorcynus* and *Acanthocybium*) will be managed under an output (quota) management system. The fishery will be divided into three zones (Gascoyne/West Coast, Pilbara and Kimberley) with specified points of landing for mackerel catch. All zones will be managed through the use of VMS, the reporting of catch prior to landing and an option for the Executive Director to vary the mackerel fishing season.

The total allowable catch for each zone of the fishery will be set by the Executive Director, after taking the best scientific and operational advice available to him to ensure sustainability of the mackerel fishery.

Access to the fishery will be based on catch history in a specified criteria period, with the level of access entitlement being determined by catch levels during the criteria period.

A draft application has been submitted for the mackerel fishery as part of Environment Australia's ecological sustainability reporting process under the *Environment Protection and Biodiversity Conservation Act 1999*. A final application is being developed which will be submitted to EA in 2004.

#### **Governing Legislation/Fishing Authority**

Fish Resources Management Regulations 1995  
Fishing Boat Licence

#### **Consultation Process**

Department–industry meetings

### Research Summary

Two mackerel-related FRDC funded research projects were completed in 2002. Both projects focused on the narrow-barred Spanish mackerel, *Scomberomorus commerson*, which is the main target species in the Western Australian mackerel fishery. Firstly, a joint WA/NT/Qld project was conducted to determine the stock structure of Spanish mackerel in northern

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Australia and, secondly, a stock assessment of Spanish mackerel in Western Australia was conducted to gather biological information and analyse catch and effort data for the commercial fishery. With the aid of fisheries models, the results of these projects are now being used to determine the status of mackerel stocks in Western Australian waters and will provide a basis for management arrangements to control the future catches from the fishery.

The following status report summarises the research findings for this fishery presented in the ESD application, which are based primarily on data for Spanish mackerel.

## Spanish Mackerel Stock Status Report

Prepared by M. Mackie and K. Smith

### FISHERY DESCRIPTION

#### Boundaries and access

Spanish mackerel are widespread throughout the Indo-West Pacific. In Western Australia, they are fished commercially from Geraldton northwards to the Northern Territory border. Mackerel are reported as far south as Albany on rare occasions. Spanish mackerel are usually captured at or near the surface in coastal areas around reefs, headlands and shoals. Anecdotal evidence suggests that many also spend time dispersed in deeper offshore waters, particularly during summer when the coastal fishery is generally not viable. Results of the recent stock structure project suggest that the extent of along-shore movement by Spanish mackerel in northern Australia is limited (typically < 100 km). Therefore, the stock in Western Australia probably consists of spatially discrete subpopulations of adults.

Most of the commercial catch is taken from May through to October, with minor catches made during summer in the Pilbara and Kimberley regions when weather conditions permit. Under the interim management plan (IMP), the fishing season will be restricted to a period of six months in each sector. Access to the mackerel fishery will also be restricted to fishers who meet certain criteria.

Catches in the mackerel fishery are reported in four sectors, described below. However, at the commencement of the IMP in 2004, the West Coast and Gascoyne sectors will be combined.

**Kimberley sector:** The use of dories (5–6.5 m dinghies) is restricted to this sector, which extends east of longitude 121° E (previously 120° E) to the Northern Territory border. Dories troll two to three lines and work to a mother boat that is about 20 m in length. Fishing gear used in this sector is relatively heavy (8–10 mm rope with a 200+ kg mono line and wire trace), crew numbers vary between three and five, and fishing trips generally last between one and three weeks. Mackerel captured in this sector are usually filleted, boxed and frozen for distribution throughout Australia.

**Pilbara sector:** This sector extends from longitude 114° E to 121° E and north of 23° S. Vessels used in this area are between 9 and 15 m in length (no dories), with one to two

crew using 180 kg mono line and wire trace. In recent years the main catches from this sector have come from the Port Hedland area. Fishing trips usually last less than a week, and the product is trunked, brined, and sold locally or sent fresh to Perth markets.

**Gascoyne sector:** This sector extends from 27° S to 23° S. Vessels used in this area are between 7 and 15 m in length and are crewed by one to two persons for trips lasting one to five days. Gear used is rod and reel with 20–30 kg line and wire trace. Fish caught by Carnarvon- and Quobba-based fishers are usually kept whole in brine for export, while fish landed at other ports are usually trunked and sold locally or sent fresh to Perth markets.

**West coast sector:** This sector extends south of 27° S. Fishing gear and methods are the same as those used in the Gascoyne sector, with most catches obtained from the Geraldton and Abrolhos areas. Few commercial mackerel catches are made south of Geraldton. Note that for analyses of catch rates the Gascoyne and west coast sectors are combined.

#### Main fishing method

Trolling.

#### RETAINED SPECIES

##### Commercial production (season 2002):

**Spanish mackerel 467.9 tonnes**  
**Other mackerel 56.2 tonnes**

#### Landings

Spanish mackerel (*Scomberomorus commerson*) is the main target species and may comprise more than 90% of the catch. Grey or broad-barred mackerel (*S. semifasciatus*) is the dominant by-product, particularly in the Gascoyne and west coast sectors where it is sometimes captured in large numbers. However, fishing methods need to be modified in order to catch this species in quantity. Other by-products of Spanish mackerel fishing include spotted mackerel (*S. munroi*) and shark mackerel (*Grammatocygnus bicarinatus*), wahoo (*Acanthocybium solandri*), cobia (*Rachycentron canadum*), tunas, smaller sharks and the occasional reef fish such as spangled emperor and coral trout. Quantities of mullet, whiting and garfish are also netted by some fishers for use as bait in their mackerel fishing operations. Bait collection by mackerel fishers is currently being reviewed and may be restricted under the IMP.

The reported catch of 467.9 t of Spanish mackerel in 2002 comprised 245.8 t from the Kimberley sector, 136.8 t from the Pilbara sector, 53.5 t from the Gascoyne sector and 31.9 t from the west coast sector (Spanish Mackerel Figure 1 and Table 1).

Historic trends in catches were described in the *State of the Fisheries Report 2000/2001*. Yearly variations and the overall trends in total catch of Spanish mackerel are mainly influenced by catches in the Kimberley sector, which is the largest of all the sectors. Discussion with fishers indicated that the relatively low 2000 catch in the Kimberley region was mainly due to environmental effects on the seasonal abundance of mackerel.



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Reported catches of Spanish mackerel by recreational charter vessels are relatively minor. In 2002, approximately 18 t of Spanish mackerel were reported by charter vessels. Catches were mainly taken in the Kimberley and Pilbara sectors (75%) or Gascoyne sector (20%).

## **Stock assessment completed:** **Yes**

An initial assessment of Spanish mackerel stocks was completed in 2002, using biomass dynamics and yield-per-recruit modelling. Details were reported in the *State of the Fisheries Report 2001/2002*. Inputs to the models included biological information and annual catch and effort data. These models were not updated in the current year, although additional catch and effort data for Spanish mackerel were collected in 2002 and will be incorporated into future models.

A new time-series model was also devised to forecast Spanish mackerel catches using lagged fishery-dependent monthly catch rates and environmental interactions. The model found that an interaction between October commercial catch rates and the annual average series of the Southern Oscillation Index (SOI), both lagged two to three years, reliably predicted the aggregate commercial Spanish mackerel catch for the State. In the model, October catch rates are assumed to signify abundance of spawning stock, while the SOI is hypothesised to affect the survival of juvenile recruitment stock. The positive correlation between Spanish mackerel catches and the SOI component therefore suggests that the high catches in 2002 may be partly attributable to the high positive SOI in 1999 and 2000.

Insufficient data are available for assessment of stocks of other mackerel species.

## **Exploitation status:** **Fully exploited**

The above analyses indicate that at current catch levels the Spanish mackerel fishery is fully exploited and further increases in effort would not be appropriate. Anecdotal evidence from expert mackerel fishers suggests that grey mackerel stocks are currently under-exploited in the Gascoyne sector, although they are increasingly being targeted for the export market. The abundance of this species in the Pilbara and Kimberley sectors is unknown but it is probably under-exploited in these areas also. The status of other mackerel species has not been assessed.

## **Breeding stock levels:** **Adequate**

Spanish mackerel rapidly attain sexual maturity: size and age at 50% maturity is 898 mm and 706 mm total length for females and males respectively (< 2 years of age). With the current minimum legal size of 900 mm total length and the focus by the fishery on 1- to 3-year-old fish (59–79% of fish in the catches are in these age groups), the breeding stock is essentially the same as the exploited stock. Based on the preliminary results of the 2002 stock assessment project, the current rates of exploitation around the Western Australian coastline appear to be allowing sufficient survival of the breeding stock to maintain recruitment levels.

## **NON-RETAINED SPECIES**

### **Bycatch species impact:** **Low**

Fishing for Spanish mackerel uses specialised troll lines to target the schooling fish and involves limited discarding. Species occasionally caught and generally discarded include sailfish, billfish, pike, barracuda, shark, mackerel tuna, queenfish and trevally.

### **Protected species interaction:** **Negligible**

The line fishing methods used in this fishery do not catch any protected species.

## **ECOSYSTEM EFFECTS**

### **Food chain effects:** **Low**

The effect of the fishery on the food chain is likely to be minimal because a relatively low proportion of the total mackerel biomass is caught, and because discards of non-retained bycatch and fish waste products are low in this fishery.

### **Habitat effects:** **Negligible**

The line fishing methods used in this fishery have minimal impact on the habitat.

## **SOCIAL EFFECTS**

Approximately 68 people were employed catching Spanish mackerel during the 2002 mackerel fishing season. This estimate is based on those boats recording significant catches of Spanish mackerel (> 500 kg in the Gascoyne, > 1000 kg in the Pilbara and Kimberley). The average number of crew on each boat (2 per boat in the Gascoyne and Pilbara, 4 per boat in the Kimberley) was then pooled to determine overall employment. This estimate does not consider employment of fishers in the west coast sector or of fishers catching minor amounts of mackerel in other sectors, as they are considered employees of other fisheries. For many of the fishers included as employees of the mackerel fishery, the duration of employment is only about six months each year.

**Estimated annual value (to fishers) for year (2002):**  
**Spanish mackerel \$2.7 million**  
**Other mackerel \$310,000**

Overall ex-vessel prices for Spanish mackerel (\$5–6/kg) and other mackerel (\$4–6.50/kg) were obtained from fish processors and represent an average price per kilogram of whole weight. Actual prices paid to fishers for their product may reach over \$10/kg for fillets and trunks, particularly during summer when few mackerel are captured.

## **FISHERY GOVERNANCE**

### **Acceptable catch range:** **275–417 tonnes**

Acceptable catch ranges for the individual sectors were previously based on historic catch ranges, but were revised in late 2002 to be more consistent with new management arrangements to be introduced under the IMP. Revised catch ranges in each sector, except the Gascoyne, were based on

the minimum and maximum catches occurring within the criteria period of 1991–1997. Therefore, revised acceptable catch ranges are Kimberley: 150–198 t, Pilbara: 69–134 t and west coast: 6–15 t. In the Gascoyne, catches ranged from 9 to 78 t during the criteria period. However, unusually low catches occurred from 1989 to 1995, possibly as a result of over-fishing from 1981 to 1987. Therefore, an acceptable catch range of 50–70 t, based on historic catches rather than the criteria period, has been retained in the Gascoyne.

These acceptable catch ranges may be further revised when the IMP is introduced or when the processes controlling recruitment variability in Spanish mackerel are better understood.

In 2002, reported catches were within the acceptable catch range in the Gascoyne sector. However, reported catches were above the acceptable catch range in the Kimberley and west coast sectors, and were at the maximum acceptable level in

the Pilbara sector. These relatively high catches reflect very strong recent recruitment to the fishery and are not considered to be a threat to the sustainability of the resource. Catches are expected to fall back within acceptable ranges in the next one to three years, partly as a result of natural fluctuations in abundance. Also, future catches will be constrained by catch quotas and other management measures implemented under the IMP.

## EXTERNAL FACTORS

Spanish mackerel and the other mackerel species caught by this fishery are all relatively short-lived, fast-growing species. Consequently, there are likely to be relatively large changes in the abundance of these species in the different sectors through time that are not the result of fishing but from variations in recruitment strength caused by environmental fluctuations.

## SPANISH MACKEREL TABLE I

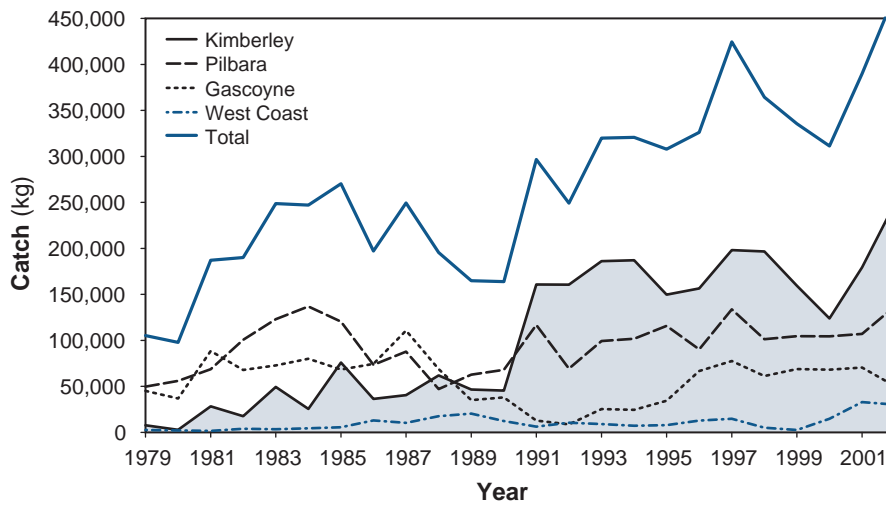
Catches of Spanish and other mackerel within each sector. The main species included under 'other mackerel' are grey mackerel (*Scomberomorus semifasciatus*), school mackerel (*S. queenslandicus*), spotted mackerel (*S. munroi*) and shark mackerel (*Grammatorcynus bicarinatus*). WC = west coast sector.

YEAR	SPANISH MACKEREL (tonnes)					OTHER MACKEREL (tonnes)				
	KIMBERLEY*	PILBARA	GASCOYNE	WC	TOTAL	KIMBERLEY	PILBARA	GASCOYNE	WC	TOTAL
1980	2.8	56.0	36.9	2.2	97.9	0.0	8.6	2.1	0.0	10.8
1981	28.3	68.7	88.5	1.7	187.2	1.9	0.4	0.1	0.1	2.5
1982	17.6	100.7	67.8	4.0	190.1	3.3	3.6	11.8	1.2	19.9
1983	49.5	123.0	72.8	3.5	248.7	0.0	2.2	0.9	0.6	3.6
1984	25.5	136.9	80.1	4.5	247.0	0.4	1.2	0.2	0.0	1.8
1985	75.9	120.4	68.3	5.7	270.3	11.7	5.7	2.0	0.1	19.4
1986	36.4	73.5	72.3	12.9	195.1	16.7	11.4	8.9	2.2	39.2
1987	40.6	87.8	110.6	10.3	249.3	12.2	2.3	8.6	0.7	23.9
1988	62.0	47.1	68.8	17.6	195.5	56.6	16.2	3.3	13.3	89.3
1989	46.6	62.7	35.1	20.4	164.8	13.4	35.8	18.2	37.1	104.5
1990	45.4	68.0	38.1	12.3	163.8	24.8	97.3	23.6	20.9	166.4
1991	160.7	116.8	12.8	6.3	296.7	50.5	44.3	12.1	8.9	115.8
1992	160.6	69.3	8.7	10.6	249.2	37.0	30.5	5.2	6.8	79.5
1993	186.1	99.3	25.4	9.1	319.9	28.0	36.4	8.1	2.4	75.0
1994	187.1	101.8	24.6	7.2	320.7	67.9	9.7	6.5	3.8	87.9
1995	149.7	115.8	34.5	7.9	307.9	27.6	15.6	9.7	2.8	55.8
1996	156.4	90.3	66.7	12.8	326.2	34.1	31.0	25.9	2.9	93.8
1997	198.2	133.2	77.6	14.9	423.9	64.7	31.8	20.6	3.5	120.6
1998	196.7	101.2	61.2	5.2	364.3	25.8	16.2	21.2	2.6	65.7
1999	159.5	104.7	68.8	2.6	335.6	26.9	7.9	32.7	5.2	72.7
2000	123.8	104.5	68.1	14.9	311.3	14.3	27.1	29.2	4.0	74.6
2001	179.3	107.0	70.5	33.0	389.9	13.7	13.0	17.7	11.5	56.0
<b>2002</b>	<b>245.8</b>	<b>136.8</b>	<b>53.5</b>	<b>31.9</b>	<b>467.9</b>	<b>16.8</b>	<b>8.7</b>	<b>16.0</b>	<b>14.7</b>	<b>56.2</b>

\* Catches by Taiwanese gillnet fishers of approximately 5–90 t per year (mean approx. 50 t) between 1980 and 1986 (Stevens and Davenport 1991) are not included in these estimates. These gillnet catches include data east to longitude 131° E and therefore are not directly comparable with Kimberley catches.

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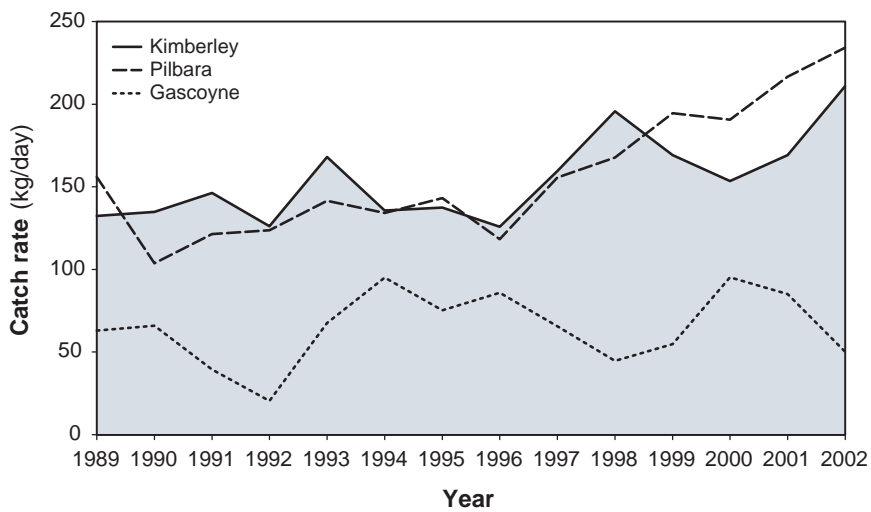
## Spanish Mackerel Annual Catch



### SPANISH MACKEREL FIGURE 1

Annual catch of Spanish mackerel in Western Australia.

## Spanish Mackerel Annual Catch Rate



### SPANISH MACKEREL FIGURE 2

Estimated catch per unit effort (kg/day) for vessels specialising in catching Spanish mackerel. Effort data was based on only those vessels known to target the species.

