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Department of the Environment and Heritage

Assessment of the
Western Australian Salmon Managed Fisheries

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Disclaimer

This document is an assessment carried out by the Department of the Environment and Heritage of a commercial fishery against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. It forms part of the advice provided to the Minister for the Environment and Heritage on the fishery in relation to decisions under Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999*. The views expressed do not necessarily reflect those of the Minister for the Environment and Heritage or the Australian Government.

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Assessment of the ecological sustainability of management arrangements for the Western Australian Salmon Managed Fisheries

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EXECUTIVE SUMMARY

Background

The Department of Fisheries, Western Australia (DFWA) has submitted a document for assessment under Part 13A of the *Environment Protection and Biodiversity Conservation Act 1999* (EPBC Act). The draft document *Final Application to the Department of Environment and Heritage for the WA Salmon Managed Fisheries* (the submission) was received by the Department of the Environment and Heritage (DEH) in July 2004. The submission was released for a thirty-day public comment period that expired on 20 August 2004. One public comment was received. The DFWA provided a response to the issues raised and amended the submission where necessary. A final submission for assessment was received in September 2004.

The submission reports on the Western Australia (WA) Salmon Managed Fisheries against the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. The DEH assessment considers the submission, associated documents, public comments and the DFWA response to the comments.

Table 1: Summary of the WA Salmon Managed Fisheries

Area	Waters adjacent to WA out to the Australian Exclusive Economic Zone (AEEZ). The two fisheries are separated at Cape Beaufort – the South Coast Salmon Managed Fishery and the South West Coast Salmon Managed Fishery
Fishery status	The target species is considered fully exploited.
Target Species	WA Salmon (*Arripis truttaceus*).
By-product Species	Not limited. Mainly other finfish and elasmobranchs.
Gear	Beach seines.
Season	No season specified in management regime, but fisheries targets a westward spawning migration in February-May and some years a eastward "back run" in May-August.
Commercial harvest 2001/02	2623 tonnes of WA salmon.
Value of commercial harvest 2002	$1.1 million.
Recreational harvest	136 tonnes (t) in 2000/01.
Commercial licences issued	30 fully transferable licences (18 in south coast salmon fishery, 15 in south west coast salmon fishery).
Management arrangements	Predominately input controlled through: • limited entry; • south coast salmon fishery operators limited to a particular beach; • possession limits for recreational fishers. Output control of minimum size limits also in place.
Export	Exported trunks to the Phillipines; additional markets being explored.
Bycatch	Considered low, consisting mostly of sharks, skates and rays, some teleosts.
Interaction with Threatened Species	Considered low. Possible interactions with seals, elasmobranchs and sea lions.

The area of the fisheries as described in the management regimes include waters surrounding the state of WA out to the outer edge of the AEEZ. All fishing takes place within State waters (ie within 3 nautical miles of the low water mark). The fisheries are managed by Western Australia.

The fishery targets WA salmon (*Arripis truttaceus*). Although initially considered a type of eastern Australian salmon (*Arripis trutta*), genetic studies conducted in the 1980s indicate that WA salmon is a separate species. There is no limit to the quantity or species that may be taken as byproduct by the fishery, however WA salmon tend to congregate in mono-specific schools and therefore little byproduct is taken. Species currently retained by the fishery as byproduct are mainly finfish (herring, mullet) and elasmobranchs.

The target species is found in the waters of southern Australia, extending from Kalbarri in WA to Eden in New South Wales, including the waters surrounding Tasmania. The species is harvested in several commercial fisheries in Australia, predominantly net-based and some trolling operations. Recreational anglers also harvest the species throughout its distribution. The bulk of the harvest of WA salmon occurs at shallow depths off beaches (Kailoa *et al*, 1993). Low levels of genetic differentiation suggest that a single stock of WA salmon exists, and population structure within the species has not been demonstrated.

The lifespan of *A. truttaceus* is 9-10 years with an average size at maturity of 540 mm fork length. Growth rates decrease from west to east across the population, with western individuals maturing in 3-4 years and eastern individuals in 4-6 years. Juveniles are found in shallow marine embayments and estuaries, but adults may be found associated with open beaches and rocky reefs, offshore to partway across the continental shelf.

WA salmon make a single migration from south-eastern waters to spawning areas off the south-western coast of WA between Busselton and Albany, after which most become resident in WA waters. Although the migration is triggered by maturity, it is size-related rather than age-related; as a consequence schools are likely to comprise individuals of similar size. Peak spawning occurs near headlands, in March to early May. The fishery targets this spawning migration, and may also operate on a smaller post-spawning eastward migration. The species is considered to be vulnerable to the effects of over-exploitation due to high natural mortality and strong schooling habits (Cappo, 1987, quoted in Kailoa *et al* 1993).

The WA Salmon Managed Fisheries harvested 2623 t of WA salmon in 2002 at an estimated value of $1.1 million. Of this, 1995 t was taken in the south coast salmon fishery, predominately from the western sector of that fishery, and a further 627.5 t was taken in the south west fishery. Catches in the past 25 years have fluctuated between 900 and 4,000 t, it is believed largely due to fluctuations in environmental factors and market demand, rather than fishing effort. The strength of the Leeuwin Current is considered an important factor; a relatively weak current results in generally cooler coastal waters and WA salmon migrate further up the west coast and into an extended area of fishing pressure.

The fishery for WA salmon began around 1940 in WA waters, initially in the Hopetoun area. The current management plans were introduced in 1982 and limit entry to those operators who held a licence endorsed for WA salmon just prior to their introduction. Although current commercial catches suggest the breeding stock is being maintained, recent egg-per-recruit analysis suggests the exploitation rate is high and therefore any substantial increase in harvest, or significant reduction in recruitment (for example through unusual environmental effects) would be detrimental to the sustainability of the stock (Penn *et al*, 2003).

WA salmon are marketed in largely domestic markets as whole fresh fish, canned for human consumption or pet food, or rock lobster bait (Kailoa *et al* 1993). A small export market for trunks and roe exists. Although the species may reach 960 mm length and a weight of 10.5 kg, small fish are considered better to eat than adults and larger fish tend to be used as rock lobster bait (Yearsley *et al* 1999). Commercial fishers target fish between 600 and 650 mm in length.

The fishery uses beach seines to take WA salmon. Salmon schools are spotted, usually from vantage points in the dunes, and boats launched to run the net from the shore to encircle the school. The net is then drawn in to the beach. Fish are not actively herded.

The main management measures for the fishery are limited entry, a minimum size limit, and in the south coast salmon fishery, a requirement that fishers operate on the beach for which they are endorsed. Currently there are 33 licences in the WA Salmon Managed Fisheries, three of which are limited to fishing between Busselton Jetty and Tim's Thicket (Mandurah). Mesh sizes and net dimensions are not prescribed in the fisheries' management plans, but the maximum net length is limited by the need for manual deployment off surf beaches. Nets are usually 400 m long with a drop of 2-6 m. Fishers use a mesh size that is large enough to allow escapement of small animals although not so large as to target animals. Configuration of the net varies between the two fisheries. The bunt end is at the centre of the net in the south coast salmon fishery, whereas nets used in the south west coast salmon fishery often have a bag that can be tied off and transported to areas of calmer water.

Direct information on bycatch in the fishery is limited to anecdotal information, which suggest levels are low due to the relatively mono-specific nature of schools of target species when on their spawning run. Species-specific data on bycatch are unavailable, but it is believed some elasmobranches are taken. The submission indicates that protected shark species would not be included among those taken, because their retention is illegal and live release is possible. Nonetheless, as some elasmobranch species are currently listed protected species under the EPBC Act, information to species level would be desirable. Possible protected species interactions in this fishery include encirclement of seals and sea lions in the seine net. Interactions with cetaceans and seabirds would appear feasible, but are not recorded. Limited evidence to date suggests that interaction with any protected species group is very low. These interactions are assessed under Principle II of this report.

WA salmon is considered a desirable recreational fish in WA and a prime sport fish in South Australia (SA) (Kailoa *et al*, 1993). The harvest of WA salmon in recreational fishing was estimated to be 154.3 t in 1994, 183.4 t in 1995, and 136 t in 2000-01. These data suggest that the recreational take is relatively constant, but likely to be influenced by the natural variability in salmon numbers. Indigenous take is considered to be minimal. Most of the finfish species caught as byproduct and/or bycatch in the WA salmon fisheries, are targeted and/or taken in other commercial fisheries.

The fisheries are managed under the WA *South Coast Salmon Fishery Management Plan 1982*, the WA *South west coast salmon fishery Management Plan 1982*, the *Proclaimed Fishing Zone Notice (South Coast) 1975*, and the *Proclaimed Fishing Zone Notice (South West Coast) 1975*. These instruments obtain their authority from the WA *Fish Resources Management Act 1994*.

Overall assessment

The material submitted by the DFWA indicates that the South Coast Salmon Managed Fishery and the South West Coast Salmon Managed Fishery operate in accordance with the Australian Government *Guidelines for the Ecologically Sustainable Management of Fisheries*. DEH considers that the South Coast Salmon Managed Fishery and the South West Coast Salmon Managed Fishery are well managed fisheries that are unlikely to have an unacceptable or unsustainable impact on the environment in the short to mid term. Recommendations have been developed to ensure that the risk of impact is minimised in the longer term. Overall, the management regime of limited entry and restricted access to specific fishing grounds suggests that the fisheries are being managed in an ecologically sustainable way.

In making its assessment, DEH considers that the management arrangements, including monitoring arrangements and management objectives, are sufficient to ensure that the fisheries are conducted in a

manner that does not lead to over-fishing and that stocks are not currently overfished. Considering the management arrangements in place and the selective characteristic of the fishery operations, DEH considers that fishing operations are managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem. Management of these fisheries has a history of reacting appropriately to threats to sustainability and DEH is confident that DFWA will continue to provide this high quality management.

The assessment finds that the fisheries are managed in an ecologically sustainable way and their operation is consistent with the objects of Part 13A of the EPBC Act. DEH recommends that the export of species taken in the fisheries should be exempt from the export requirements of Part 13A of the EPBC Act, with that exemption to be reviewed in five years. DEH considers that the fisheries, as managed in accordance with the management plans, are not likely to cause serious or irreversible ecological damage over this period.

To further strengthen the effectiveness of the management arrangements for the South Coast Salmon Managed Fishery and the South West Coast Salmon Managed Fishery, and to contain the environmental risks in the medium to long term, DEH has developed a series of recommendations. The implementation of these and other commitments made by DFWA in the submission will be monitored and reviewed as part of the next DEH review of the fishery in five years time.

Recommendations

1. DFWA to advise of any material change to the fisheries' legislated management plans and/or management arrangements that could affect the criteria on which EPBC decisions are based, within 3 months of the change being made.
2. DFWA to ensure, where appropriate, that any relevant indigenous, conservation and recreational interests in the fishery are considered through consultative mechanisms.
3. The ESD Report, including all performance measures, responses and information requirements to be incorporated into the management regime and decision making process.
4. DFWA to incorporate into the management regime, an objective to minimise protected/listed species interactions, to minimise or maintain the take of other non-retained at sustainable levels and to minimise impacts on the marine environment.
5. DFWA, in its Annual State of the Fisheries Report, to report on the performance of the fishery against performance measures that relate to the sustainability of the fishery.
6. DFWA to continue to cooperate with other relevant jurisdictions to pursue complementary management and research of shared target stocks.
7. DFWA to develop and implement a system to periodically validate fishery dependent data on catch and effort for all target and byproduct species within 2 years.
8. DFWA to implement, within 1 year, a more precautionary performance measure for the major target species sufficient to ensure that harvest is maintained within sustainable levels and that significant changes in the stock abundance can be detected.
9. DFWA to collect data on non-retained species in the fisheries, sufficient to validate assumptions and inform future reviews.
10. DFWA to provide a mechanism, which allows fishers to record interactions with protected/listed species. DFWA to implement an education program to ensure that industry has the capacity to make these reports at an appropriate level of accuracy.

PART I - MANAGEMENT ARRANGEMENTS

The South Coast Salmon Managed Fishery and the South West Coast Salmon Managed Fishery are managed by the Department of Fisheries Western Australian (DFWA).

The management regimes are described in the following documents, all of which are publicly available:

- The *South Coast Salmon Fishery Management Plan 1982;*
- The *South West Coast Salmon Fishery Management Plan* 1982;
- The WA *Fish Resources Management Act 1994;*
- The draft WA Salmon Managed Fisheries ecologically sustainable development component reports (Ecological Sustainable Development report); and
- Relevant fisheries notices and licence conditions.

A number of other documents, including research reports, scientific literature and discussion papers are integral to the management of the fishery.

DEH considers it important that management arrangements remain flexible to ensure timely and appropriate managerial decisions. Due to the importance of the management plan and documents referred to above to DEH's assessment of the fishery, an amendment could change the outcomes of our assessment and decisions stemming from it. Decisions resulting from this assessment relate to the arrangements in force at the time of the decision. In order to ensure that these decisions remain valid, DEH needs to be advised of any changes that are made to the management regime and make an assessment that the new arrangements are equivalent or better, in terms of ecological sustainability, than those in place at the time of the original decision.

Recommendation 1: *DFWA to advise of any material change to the fisheries' legislated management plans and/or management arrangements that could affect the criteria on which EPBC decisions are based, within 3 months of the change being made.*

Management of the fishery incorporates a limited amount of consultation focused largely on industry. Consultation on management arrangements with wider stakeholders in the past does not appear to have been widespread. There is no formal management advisory group, but DFWA holds meetings with industry and the WA Fishing Industry Council on a regular basis, including annual data review and management discussions. Discussion papers and proposals are automatically distributed to industry, on request to other interested persons and some are be available on the DFWA website (www.fish.wa.gov.au). Management of the WA salmon fisheries is occasionally considered by the Recreational Fishing Advisory Committee (RFAC), a body appointed under the WA *Fish Resources Management Act 1994* to advise the WA Minister responsible for fisheries on recreational fishing issues.

DEH is concerned that the consultation on management of the fisheries is limited to industry members and DFWA officers, and recommends that DFWA provides opportunity for other parties to be involved in management of the fisheries. DFWA has given a commitment to investigate alternative means of effective consultation to include a wider variety of stakeholders. In 2003 commenced a program of public meetings around the state to inform the public on the status of management and research in the state's fisheries. DEH believes these meetings are a valuable mechanism for informing the public, however are unlikely to focus solely on these fisheries and therefore DEH considers the level of consultation requires improvement. DEH encourages DFWA to expand consultation on the management of the fisheries and in particular, consider expansion of the next review of the ESD report for these fisheries to a workshop involving greater consultation with stakeholders.

Recommendation 2: *DFWA to ensure, where appropriate, that any relevant indigenous, conservation and recreational interests in the fishery are considered through consultative mechanisms.*

The ESD report, on which the submission is largely based, is an integral part of the management regime. It examines benefits and costs associated with the fisheries. It also identifies and assesses risks posed to the fisheries and environmental components. The ESD Report will document the performance of the fisheries and their management in terms of the ecological, economic, social and governance issues associated with the fisheries. This report will be publicly available in document form and on the DFWA website.

The ESD report is yet to be finalised and is not currently a formal component of the legislative arrangements for the fishery, however the management commitments specified in this report have been fundamental in DEH's assessment and consequent recommendations. Although DEH is satisfied that this lack of a legislative base will not cause issues in the fisheries in the short term, we recommend that the report be formally incorporated into the management regime and decision making process. DFWA has advised that it proposes to formally publish the management objectives and performance measures for the fishery as part of a series of Ministerial guidelines. The Ministerial Policy Guidelines will provide the policy framework for the management for each fishery. This document will reflect the management objectives, philosophy and guidance for decision making, including the legislated management plan, the ESD report, and as relevant, reference to other documents.

Recommendation 3: *The ESD Report, including all performance measures, responses and information requirements to be incorporated into the management regime and decision making process.*

Objectives, indicators, performance measures and management response are detailed in the ESD report for the fisheries. If there is a breach in a performance measure, this is reported in the State of the Fisheries Report. If a breach materially affects the sustainability of the target species or negatively impacts on byproduct, bycatch, protected species or the ecosystem, the breach will be reported to the Minister for Fisheries within 3 months for subsequent management review and action with timeframes for implementation.

A single operational objective, indicator and performance measure have been developed to cover total removals of the target species in both fisheries. The management objectives of the fisheries, contained within the ESD reports, do not currently contain an objective to minimise the take of bycatch, the impact on protected species or impacts on the marine environment. DFWA does not consider it necessary to develop such objectives as the risk assessment process considered the risk posed by the fisheries to these components negligible. DEH recognises that the fishing method and mono-specific schooling nature of WA salmon should mean that there is little likelihood of significant interactions with bycatch or protected species, but notes there are very little data available to demonstrate this (see Recommendations 9 and 10).

Minimising the incidental take of non-retained species and protecting listed species and the marine environment from impacts of the fishery should be an explicit priority in the management of the fishery, regardless of the level of impact. DEH recommends that a management objective to minimise impacts on bycatch, protected species and the marine environment be developed and incorporated in the management regime.

Recommendation 4: *DFWA to incorporate into the management regime, an objective to minimise protected/listed species interactions, to minimise or maintain the take of other non-retained at sustainable levels and to minimise impacts on the marine environment.*

Management of the fishery is predominately based on input controls. These controls include:

- Limited entry, with 18 south coast salmon licences and 15 south west coast salmon licences (three of which are limited to fish between Busselton Jetty and Tim’s Thicket, Mandurah);
- For the South Coast Salmon Managed Fishery, access is limited to specific beaches identified on licences;
- For the South West Coast Salmon Managed Fishery, licensees are not restricted to specific beaches but in practice only a few beaches are fished.

Output controls implemented in the fisheries include:

- Minimum size limit of 300 mm fork length;
- An acceptable catch range, based upon long time-series data.

An analysis of the effectiveness of these measures is included in Part Two of this report.

Compliance and enforcement tools utilised in the fishery relate to licence conditions, in particular possession of a relevant licence and adherence to the conditions on that licence, such as operating on the beach designated on the licence (south coast salmon fishery only). Fishing teams are required to have the licence with them when fishing and enforcement measures include random beach patrols, and annual licence and gear inspections. The level of compliance monitoring is relatively low. No breaches were detected in 2000, 2001 and 2002. A system of Voluntary Fisheries Liaison Officers is in place to ensure recreational fishers are aware of the regulations.

DEH considers that these compliance measures, given the beach-based and highly seasonal nature of the fisheries, contain the means of enforcing critical aspects of the management arrangements.

The performance of the South Coast Salmon and South West Coast Salmon fisheries is subject to annual review. In addition, the ESD report for the fisheries will be reviewed in five years. An annual review of performance of the fishery is undertaken through the analysis of catch levels and intra-annual variations in catch. DEH considers that a five year review of the entire fishery is suitable as long as critical aspects, such as the performance of the fishery against performance measures, are reviewed annually. In addition, the outcomes of these reviews should be publicly available in the annual review of major aspects of the fisheries.

Recommendation 5: *DFWA, in its Annual State of the Fisheries Report, to report on the performance of the fishery against performance measures that relate to the sustainability of the fishery.*

Fishery-dependent data relating to the target species is collected on a regular basis in the fishery. The collection of fishery independent information is limited. Discussion of information collection in the fishery can be found in Part II of this report.

An analysis of the fisheries' capacity for assessing, monitoring and avoiding, remedying or mitigating any adverse impacts on the wider marine ecosystem in which the target species lives and the fisheries operate is contained under Principle Two of this report.

The WA salmon stock is also subject to fishing pressure in SA. Minor amounts of WA salmon are also taken in fisheries targeting eastern Australian salmon in Victoria and Tasmania. Ideally, management arrangements affecting a single stock should be under a single jurisdiction, or at least complementary across jurisdictions. Although collaborative or co-operative management arrangements between DFWA and the SA fisheries management agency are not in place, there is close liaison between the two management agencies to ensure that the biological status of the stock is maintained. DFWA is in regular contact with Primary Industries and Resources South Australia (PIRSA), with whom they routinely exchange research information and detail on annual commercial catches within their jurisdictions. While SA catch data is considered in the DFWA catch analysis, data from other jurisdictions is not obtained regularly nor incorporated in DFWA's management of the WA salmon stock. DEH recommends that DFWA continue to liaise with all other jurisdictions where WA Salmon is harvested to ensure that management is complementary. DEH encourages DFWA to establish processes enabling the exchange of catch data with other jurisdictions for incorporation in the assessment of WA salmon.

Recommendation 6: *DFWA to continue to cooperate with other relevant jurisdictions to pursue complementary management and research of shared target stocks.*

DEH considers that the current management arrangements comply with all relevant threat abatement plans, recovery plans, the National Policy on Fisheries Bycatch, and bycatch action strategies developed under that policy. DFWA has committed to complying with any future plan or policies.

No regional or international management regimes, to which Australia is a party, are of direct relevance to the fisheries. The prime international regime affecting the fishery is the United Nations Convention on the Law of the Sea (UNCLOS). The management regime essentially complies with this. Other international regimes are applicable to fisheries management but do not explicitly involve this fishery, for example the 1992 Convention on Biological Diversity and in particular the 1995 Jakarta Mandate requiring that, in relation to the sustainable use of marine and coastal biological diversity, the precautionary principle should apply in efforts to address threats to biodiversity. While these agreements are not specifically addressed in the Submission, the fisheries' compliance with their requirements can be assessed by examination of Part Two of this report. The application of the International Convention for the Prevention of Pollution from Ships (MARPOL) to vessels operating in the fisheries is implicit in the discussion under Principle 2, Objective 3.

DEH considers it is incumbent on all authorities to develop a thorough understanding of the framework of national, regional and international agreements and their applicability to export-based fisheries for which they are responsible.

Conclusion

DEH considers that the South Coast Salmon and South West Coast Salmon fisheries management regimes are documented, publicly available and transparent, and are developed through a consultative process that could be further improved. The management arrangements are adaptable and underpinned by adequate objectives and performance criteria, which with further refinement will allow the effectiveness of the management arrangements to be measured, enforced and reviewed.

The management arrangements are capable of controlling the harvest through a combination of input and output controls appropriate to the size of the fishery. Periodic review of the fishery is provided for, as are the means of enforcing critical aspects of the management arrangements.

The management regime takes into account arrangements in other jurisdictions, and adheres to arrangements established under Australian laws and international agreements.

DEH considers that there is scope to further refine the management arrangements and has provided recommendations for improvements in the longer term.

PART II – GUIDELINES FOR THE ECOLOGICALLY SUSTAINABLE MANAGEMENT OF FISHERIES

Stock Status and Recovery

Principle 1: *'A fishery must be conducted in a manner that does not lead to over-fishing, or for those stocks that are over-fished, the fishery must be conducted such that there is a high degree of probability the stock(s) will recover'*

Maintain ecologically viable stocks

Objective 1: *'The fishery shall be conducted at catch levels that maintain ecologically viable stock levels at an agreed point or range, with acceptable levels of probability'*

Information requirements

Fishery dependent data are obtained through compulsory monthly commercial fisher returns under the Catch and Effort System (CAES). The returns, submitted on a monthly basis, contain information on WA salmon catch, effort and location of fishing. The CAES provides good quality catch data dating back to the 1970s, with further data of potentially lesser quality dating back to the 1950s. The recording of byproduct is limited to the south coast salmon fishery, as most fishers in the south west also have licences in other net fisheries in the area and it is therefore difficult to separate their catches from each licence endorsement. The take of other species in the south west will be assessed as part of general beach seining operations.

Additional fishery dependent data is available from voluntary research logbooks filled out on a daily basis. Research logbook returns can be as low as 30%, however DFWA does not propose to allocate additional resources to improve return rates. Additional fishery dependent data has been obtained from, or for, various research projects. Data on age structure of the WA Salmon catch was collected in the fisheries until 2000. DEH believes that fishery-dependent data reliability for target species is reasonable, given the scale and nature of the fisheries and little incentive to under report.

In the past, validation of commercial logbooks was possible through daily processor returns and factory receival data, but the collection of these data by DFWA was discontinued from 2000 and 1996 respectively and currently there is no regular catch data validation. Factories continue to collect receival data, which may be used for catch data validation when errors in data recording are identified. Data from the voluntary research logbooks also may be used in validating questionable returns. DEH is concerned that the data validation mechanisms available in the fisheries are rudimentary, largely relate to landed target species, and are utilised only when aberrant data are detected. As the stock is currently considered to be fully fished and the only mechanism for identifying undesirable change is the analyses of catch data, DEH recommends that a periodic data validation process be instigated.

Recommendation 7: *DFWA to develop and implement a system to periodically validate fishery dependent data on catch and effort for all target and byproduct species within 2 years.*

Fishery-independent data collection is limited and most research undertaken to date has relied upon CAES data, recreational fishing surveys, or catch data relating to fisheries managed by other jurisdictions. Recent research has focused on the development of a fishery-independent index of juvenile recruitment, however DFWA report there is inadequate funding available for implementation of research outcomes.

DFWA has proposed further research, including an update and re-evaluation of a harvest strategy evaluation model based on fishery dependent data and the development of a predictive model of the status of the spawning biomass. There are no timeframes for completion of these projects or the development of a WA juvenile recruitment index, due to limited resources. South Australian Research

and Development Institute (SARDI) is developing juvenile recruitment indices, which have proved useful to DFWA by improving the understanding of the WA recruitment process and factors affecting it.

Data on recreational harvest is also collected and utilised in the management of the fisheries. There have been two State recreational fishing surveys (1994, 1995), one boat-based creel survey (1996-97) and the National Recreational and Indigenous Fishing Survey (2000-01) from which salmon harvest by recreational fishers may be estimated. As an additional source of information on WA salmon harvest, DFWA introduced a fishing tour operator logbook in 2001.

Overall, given the range of fishery dependent and independent data gathered by DFWA, DEH considers that there is a basic, reliable information collection system in place appropriate to the scale of the fishery. Continuation of existing data collections and research programs, combined with some extension and refinement of such activities will be important for the future management of the fishery, as will the introduction of an effective method of regularly validating catch data.

Assessment

The distribution of the WA salmon stock is understood to be from Kalbarri on the west coast of WA southwards and east to the waters of Victoria and Tasmania. Low levels of genetic differentiation suggest there is a single stock throughout this range. The WA fishery primarily targets adult WA salmon on a spawning migration. As some adults remain in WA waters after the spawning migration, it is probable that some fish caught are not taken during the spawning run. Kailoa *et al* (1993) note that until the 1980s the WA salmon migratory run went up as far north as Perth, but has retreated southward from that point. The extent of the northerly spawning run is considered to be a reflection of environmental conditions, particularly the strength of the Leeuwin current.

Potential removals from the WA salmon population include direct harvest and discards in the WA Salmon Managed fisheries, recreational harvest, direct harvest in other WA fisheries and those managed by other jurisdictions.

Commercial catch of WA salmon has fluctuated between 900 and 4,000 t over the last 25 years, with a catch of 2623 t in 2002. Harvest of WA salmon in the two fisheries makes up the vast majority of catch. Estuarine catches for the past ten years have been less than 3 t per year and there is no catch of WA salmon in shark netting fisheries. It is currently illegal to land salmon in the shark fishery. The WA Demersal Net and Hook Fisheries Management Advisory Committee is considering this issue and discussing management arrangements, including an allowance of 10 t of WA salmon to be taken per year in the demersal gillnet and longline fisheries.

Data on the discarding of WA salmon is not recorded nor required by the management regimes for the two salmon fisheries. Discarding is not likely to be a significant issue with regard to the target species as the fisheries operate on a size-related spawning run and schools are likely to comprise individuals of similar size. Therefore discarding on the basis of inappropriate size is likely to be limited. Furthermore, DFWA notes that a significant number of fish are released after capture by the recreational sector, and that release into shallow water is likely to result in a high rate of survival. Providing there is little or no crushing effect in the bunt end of net, and providing the fish are not left without sufficient water, it is likely survivorship of fish released from commercial operations will be similarly high. DEH considers the ongoing collection of data and monitoring for discards important for stock assessment purposes and to measure the overall impact the fishery may be having, not only on the target species, but also on other components of the marine environment. Therefore DEH encourages DFWA to implement a process to enable fishers to record and report discard data with a view to incorporating discard estimates in the total annual harvest of WA salmon.

Recreational harvest is considered in the assessment of the fisheries' management against performance measures. The 1995 survey produced an estimate of 184 t of WA salmon harvest and based on the data available the recreational take has shown little variation over time.

Environmental effects influence the annual catch of WA salmon. In years with an early, strong Leeuwin Current the WA salmon spawning run tends to remain in cooler offshore waters and be less susceptible to the beach-based fishing operations of the two fisheries. Market availability also may influence catch levels, as fish generally are sold to processors and fishers tend to make sure processors can handle the catch before engaging in the fishing operation. Catch effort suggests that fishing effort is steady or declining slightly.

Fishery dependent information is analysed annually against the performance measure for target species in the fisheries' ESD report. The performance measure is an annual acceptable catch range of 1300-3600 t based on the last 35 years of data for the total catch in the south coast and south west coast fisheries, the commercial estuarine and shark net fisheries, and the recreational sector. Annual assessments against the performance measure are published by DFWA in 'State of the Fisheries' reports.

A maximum sustainable yield (MSY) estimate for WA salmon of 2,500 t has been derived from a preliminary biomass dynamics model based on catch data from the last 30 years. The long-term average catch for all sectors (2,000 t) is less than the sustainable yield estimate of 2,500 t. Catch in 2002 did exceed the sustainable yield estimate, however was well within the acceptable catch range. DEH is concerned that catch levels could exceed the sustainable harvest estimate and would not trigger management action. This is discussed further under management responses (see Recommendation 8).

Research has shown that the age composition of WA salmon catch has changed from predominately 5+ to 6+ years of age in the 1950s-1960s to predominately 3+ to 4+ years of age in the 1970s-1990s. This change in age structure may reflect the result of a greater degree of fishing pressure than anticipated and may have a negative impact on the sustainability of the stock in the medium to long term.

DFWA has undertaken preliminary egg-per-recruit and yield-per-recruit analyses, which suggest that, although many smaller fish are being harvested, egg availability has not been adversely affected. This would imply that WA salmon breeding stocks are being exploited at a sustainable level. The egg-per-recruit analysis also provides a reference point for fishing mortality beyond which the spawning stock would decline below the limit reference of 30% virgin biomass. The average fishing mortality for the period 1975-94 (including the SA catch, but not that in other jurisdictions) is below the reference point, but indicates the exploitation level is high and an increase in exploitation rates could take the stock below the 30% of virgin biomass reference point. Given that recruitment is a function of SA as well as WA nursery areas, DFWA recognise that an index of the relative contributions of these nursery areas needs to be incorporated into the analyses. However, WA report that current resources will not extend to undertaking such work. DEH considers the development of effective analyses would be a valuable asset to the management of the fisheries in both SA and WA, and suggests that collaborative work between the two jurisdictions be considered (see Recommendation 6).

Management response

The management objective for the target species in the fisheries is to maintain the spawning stock at or above 30% of virgin biomass. Formal stock assessments for WA salmon in the fisheries have not been conducted. A performance indicator and performance measure have been developed to achieve this objective. The indicator is the actual catch level, and the performance measure is an annual acceptable catch range of 1,300-3,600 t. If annual catch is outside of this range DFWA will consider making changes to the management arrangements. If the breach materially affects the sustainability of the target species, the breach will be reported to the WA Minister for Fisheries within 3 months for subsequent management review and action with timeframes for implementation.

DEH is concerned that the performance measure (acceptable catch range of 1,300 – 3,600 t) is not explicitly linked to the operational objective for the major target species, rather it is based on historical catch levels. Preliminary estimates of MSY, age composition data, and egg-per-recruit analyses

suggest that exploitation rates in the fisheries are high. DFWA states that any increase in harvesting will push the spawning stocks below the recommended limit of 30% of virgin biomass. It is therefore important that DFWA have in place a measure to ensure that catch is maintained within sustainable levels. The upper current acceptable catch range, with an upper limit of 3,600 t, is unlikely to be sustainable as it is considerably higher than the estimated MSY (2,500 t). DEH is concerned that harvest of WA salmon could occur at levels above the estimate for sustainable yield without triggering any management review or changes. In addition, DEH is concerned that this broad catch range, based on historical catch is not sufficiently precautionary to detect significant changes in the abundance of stock, whether fishing effort or environmental influences causes them. DEH therefore recommends that DFWA review the performance measure, and implement a measure that will ensure the total harvest of WA salmon is maintained within sustainable levels and that significant changes in the stock abundance can be detected and responded to appropriately.

Recommendation 8: *DFWA to implement, within 1 year, a more precautionary performance measure for the major target species sufficient to ensure that harvest is maintained within sustainable levels and that significant changes in the stock abundance can be detected.*

Input and output controls in place to achieve the management objective are outlined in Table 1 and Part I of this report. DEH considers that the input controls appear to have the potential to be effective in south coast salmon fishery, as effort is limited not only to a specific number of licenses but also to nominated beaches. There is less stringent control evident in the south west fishery, where effort is not limited to particular beaches. It is the current practice in the south west to fish a limited number of beaches, but there is potential for fishing activity to expand to other beaches. DEH recognises that one factor reducing the risk of expansion is that preferential access to the fished beaches is arranged for WA salmon fishers during the salmon spawning run. Although an expansion of the fishery could have impacts on sustainability of the fishery at this time, the establishment of a precautionary performance measure, as discussed in Recommendation 8, will ensure total harvest is maintained within sustainable measures and the spawning stock levels should therefore not be negatively impacted.

DEH notes that the management regimes may rely to some extent on market forces as a measure of controlling effort. The number of processors that take WA salmon is limited, and some fishers do not go fishing until they have made certain processors can receive their catch. It is not clear whether the limitation placed on catch by processors reflects a limited capacity to absorb fish, or whether it reflects a market that is unable to absorb large quantities of fish. In either case, changes – such as the commissioning of a new processing plant or the development of new markets or products – have the capacity to undermine any reliance placed upon market forces. DEH believes that an analysis of the influence of changes in the market on fishing effort would be useful.

The management of the recreational fishery for WA salmon includes a bag limit and minimum size limit of 300 mm. There is no requirement for a recreational licence, although licences are required in some other recreational fisheries in WA (e.g. rock lobster, marron).

DEH notes that DFWA has partially developed other tools to inform managers on the effectiveness of the management regimes. One notable tool is a harvest strategy evaluation model, based on 30 years of data. This has neither been published nor used to provide management advice. Recent examination of the model has suggested it requires refinement, however it appears a promising line of research for the future management of the fisheries. DEH encourages DFWA to continue to refine such tools with a view to employing them in the fisheries' management in the future.

The submission indicates that minor quantities of other fish species are taken in the south coast salmon fishery. Byproduct in this fishery is mainly shark, skates and rays, herring and mullet, at harvest levels of less than 1 t per species group. The primary byproduct species are targeted in separate fisheries and their incidental capture is accounted for in management of those fisheries.

DEH concurs with the assessment that byproduct levels in the south coast salmon fishery are low, and that it is likely similarly low levels of byproduct will be taken in the south west coast salmon fishery, however this will be assessed as part of general beach seining operations. The nature of the fishing

operation, in particular the practice of setting beach seines on fairly mono-specific schools, should ensure byproduct it limited. Increased validation of data, as required in recommendation 7, will assist with confirming this assessment.

Conclusion

DEH considers that the management regimes in the South Coast Salmon Managed Fishery and the South West Coast Salmon Managed Fishery are appropriately precautionary and provide for the fisheries to be conducted in a manner that does not lead to over-fishing. DEH considers that the information collection system and stock assessment and management arrangements, although minimal, generally are sufficient to ensure that the fisheries are conducted at catch levels that maintain ecologically viable stock levels within acceptable levels of probability.

DEH considers that there is scope to further refine some of the existing information collection, assessment and management responses and has provided a number of recommendations for improvements in the longer term.

Promote recovery to ecologically viable stock levels

Objective 2: *'Where the fished stock(s) are below a defined reference point, the fishery will be managed to promote recovery to ecologically viable stock levels within nominated timeframes'*

This objective is not applicable to the fisheries at present, as the fishery is not considered overfished. The management contains an objective for target species to minimise the risk of recruitment overfishing. The development of a precautionary performance measure in accordance with Recommendation 8 should ensure that harvest remains within sustainable levels.

Conclusion

DEH considers that the WA salmon stock is not below a defined reference point but should that occur in the future, DFWA is required to review their management arrangements so that there is a high degree of probability the stock would recover to ecologically viable stock levels within nominated timeframes.

Ecosystem impacts

Principle 2: *'Fishing operations should be managed to minimise their impact on the structure, productivity, function and biological diversity of the ecosystem'*

Bycatch protection

Objective 1: *'The fishery is conducted in a manner that does not threaten bycatch species'*

Information requirements

No system is in place for the collection of information on bycatch caught in the south coast and south west coast salmon fisheries. Fishers are not required to record discards, and there has been no formal survey of bycatch in either fishery. Anecdotal information suggests that the bycatch in these fisheries is small. DEH considers that, given the fishing method is to set seines on fairly mono-specific schools of WA salmon, there is a low likelihood of significant bycatch occurring, and in this instance the development and implementation of an ongoing monitoring program may not be appropriate to the scale of the fishery. Nonetheless, DEH believes it would be prudent for DFWA to obtain empirical evidence of low bycatch levels to provide a basis for future.

Recommendation 9: *DFWA to collect data on non-retained species in the fisheries, sufficient to validate assumptions and inform future reviews.*

Assessment

Two non-retained species groups were identified in the ESD report as bycatch in the WA salmon fisheries; elasmobranchs and seals that are protected species (discussed in Objective 2 of this report). The risk assessment workshop concluded that the fisheries posed a negligible risk to elasmobranchs. The rationale for this is that, although as a group elasmobranches can be vulnerable to overfishing, less than 250 kg of sharks and rays are taken as byproduct in south coast salmon fishery per year (as discussed under Principle 1) and anecdotal evidence suggests that only minor amounts are discarded as bycatch. Impacts on other bycatch species were not addressed in the risk assessment.

Management response

The most significant bycatch management arrangement in the fisheries is the fishing method itself. Because nets are set by hand from small boats around reasonably mono-specific schools and are hauled to shore, the opportunity for other organisms to become encircled is reduced. Furthermore, bycatch species can be sorted out from the catch and released back into the ocean in good time and with relatively little handling, and therefore should have a good chance of survival. In addition, as fishing in the south coast salmon fishery is limited to nominated beaches, the overall impact is restricted to a relatively small area of the total fishery area. The current practice in the south west fishery of fishers electing to operate on a limited number of beaches and not on all beaches available for fishing means that overall impacts are also restricted in this fishery. DEH notes that fishers in the south west fishery have the opportunity to fish on other beaches, and as a consequence there is potential for impacts to be more widely spread in this fishery.

No bycatch monitoring arrangements are in place or proposed for either fishery, nor are there decision rules or additional management measures designed to ensure minimal bycatch is taken. Fishing effort has undergone some reduction in the two fisheries and it is likely that this reduction in effort will have had the effect of reducing bycatch levels. Current bycatch levels are likely to continue if current effort levels in the fisheries are maintained, or reduced if further fisher attrition occurs. DFWA undertakes to reassess the risk the fisheries pose in five years time. As the monitoring regime is exclusively focused on target and byproduct species, DEH has concerns that the management agency may not be in a position to identify changes in a timely manner. Nonetheless, DEH concurs that minimal bycatch levels are likely to continue if current effort levels are maintained or reduced.

Despite the low levels of bycatch likely to be taken in these fisheries, minimising the incidental take of non-retained species from impacts of the fisheries should be an explicit management priority, regardless of the level of impact. DEH recommends that a management objective to minimise impacts on bycatch be developed and incorporated in the management regime (see Recommendation 4).

Conclusion

DEH considers that there is a high likelihood the fishery is conducted in a manner that does not threaten bycatch species. Should this situation change, or a risk assessment process indicate otherwise, DEH expects that DFWA would undertake appropriate actions to ensure that bycatch species are not threatened by this fishery.

Recommendations have been developed to ensure that the risk of unacceptable impact on bycatch species is detected and minimised in the longer term.

Protected species and threatened ecological community protection

Objective 2: *'The fishery is conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities'*

Information requirements

No formal processes are in place for collecting information on interactions with protected species, and fishers are not required to record interactions with protected species. The fishery logbook, which would be an additional source of information, does not contain fields for recording interactions with protected species.

Management of protected species interactions in the fishery relies upon the limited number of fishers and the relative ease with which protected species may be released from beach seine nets. This should limit the risk of incidental capture of most protected species. There are no specific data on protected species interactions in these fisheries. Limited, generalised data (records of sick, injured and dead animals) are available on interactions with pinnipeds in WA-managed fisheries. These data are not attributable to specific fisheries, although net-based fishery interactions can be identified. Anecdotal information indicates that seal and sea lions may occasionally be surrounded by the beach seine, but the incidence of interactions is unknown. The species most likely to be affected are the Australian sea lion (*Neophoca cinerea*) and the New Zealand fur seal (*Arctocephalus forsteri*). As Australian sea lions eat a variety of finfish, including WA salmon (Shaughnessy, 1999), it is possible encirclement occurs while the sea lion is hunting.

DEH considers that priority should be given to establishing a data collection system that provides a more reliable means of monitoring and managing the impact of these fisheries on protected species. One of the biggest barriers to successful commercial reporting of protected species interactions is the capacity of the fishers to identify the species involved. In addition, many operators may not be aware of the importance of reporting for the species involved. Both of these barriers can be reduced through education programs and opportunistic advice from researchers. DEH recommends that an education program on the importance of protected species reporting and identification be run in conjunction with the introduction of reporting to increase the value of this approach.

Recommendation 10: *DFWA to provide a mechanism, which allows fishers to record interactions with protected/listed species. DFWA to implement an education program to ensure that industry has the capacity to make these reports at an appropriate level of accuracy.*

Assessment

Prior to the development of the submission, no analysis was undertaken into the risks the fisheries may pose to protected species. In developing the submission a risk assessment workshop was convened, and concluded that the fisheries posed a negligible risk to pinnipeds. Impacts on other protected species were not addressed.

Of the protected species likely to interact with the fishery, the most likely negative interactions appear to be encirclement in the seine net by seals and sea lions. The incidence of this is expected to be low, and actual capture in the fishing gear appears unlikely as the relatively short haul times and labour intensive nature of the fishing operation mean encircled animals can be released unharmed. A similar risk may exist with respect to encirclement of small cetaceans, such as dolphins, and protected shark species such as great white or grey nurse sharks. Other protected species, such as syngnathids, dugongs and marine turtles, are unlikely to be encircled in the gear because their favoured habitats do not include high energy, sandy surf beaches and they do not prey on WA salmon. The expected level of interactions with protected species will be validated with the introduction of protected species reporting in the fisheries (see Recommendation 10).

Interactions between seals and discarded fishing-associated rubbish and rope have been identified, but are unlikely to be attributable to the WA salmon fisheries as the net is not left unattended and rarely lost. No bait is used in the fishery, therefore there is no risk of entanglement in bait bands.

There are no listed ecological communities in the fisheries' area.

Management response

Apart from the prohibition on the landing of protected fish species, interactions with these species are not explicitly managed on the basis that the nature of the fishing operation means that animals encircled by the net are likely to be released unharmed. Anecdotal information suggests a low level of interactions which do not require active management. None the less, DEH is of the view that fishers should be informed of their obligations regarding protected species and actively encouraged to report any interactions, even where the protected species individual is released alive. DEH also notes that encircled animals could become aggressive and their release may be problematic. There is at least one publication dealing with the handling of protected species (Ocean Watch, 1998) which could be brought to the attention of fishers in the south coast and south west coast salmon fisheries.

DFWA has committed to review management arrangements if studies indicate an increased risk. The introduction of protected species reporting (see Recommendation 11) will provide information on which to identify change in a timely manner.

Conclusion

DEH notes that recorded interactions with protected species in these fisheries are minimal and considers that the fisheries are conducted in a manner that avoids mortality of, or injuries to, endangered, threatened or protected species and avoids or minimises impacts on threatened ecological communities. Should this situation change, or a risk assessment process or new information indicate otherwise, DEH suggests that appropriate actions be undertaken to ensure the fisheries avoid mortality, injury to these species and avoids or minimises impacts on threatened ecological communities.

A recommendation has been developed to ensure that the risk of unacceptable impact on protected species is minimised in the longer term.

Minimising ecological impacts of fishing operations

Objective 3: *'The fishery is conducted, in a manner that minimises the impact of fishing operations on the ecosystem generally'*

Information requirements

Little environmental data have been collected in the south coast and south west coast salmon fisheries. Data available for analysis of the impact of the fisheries on the marine environment is limited and largely relates to general fisheries management data (catch, effort, gear design, spatial and temporal closures). In addition, there are some publications that provide information on trophic interactions.

DEH is concerned at the lack of information collection and research covering the fisheries' impact on the ecosystem and environment generally. However, DEH understands that this lack of information is the case across a range of Australian and International fisheries and until appropriate research techniques and programs are developed and implemented this will continue to be the case. DEH strongly supports research in this area.

Assessment

The potential of the WA salmon fisheries to impact unacceptably and unsustainably on the environment generally is considered to be low. The risk assessment workshop conducted in the development of the submission concluded the fisheries posed a low risk to trophic structure and a low risk of translocation on vessel hulls; all other potential risks were rated as negligible.

WA salmon are a higher-order predator. DFWA submits that although the fisheries may have the potential to reduce mortality on salmon prey, the effect of fishing mortality is likely to be similar in magnitude to other factors affecting the natural variability of WA salmon. DFWA indicates that prey species of WA salmon are already affected by this variability and should not be unduly further affected by additional variability brought about by fishing mortality. While DEH concurs, it is noted that in years where the WA salmon run is either exceptionally high or exceptionally low, impacts on prey species may be more quantifiable.

WA salmon are among the fish species upon which Australian sea lions also prey. Sea lions have been known to take salmon from nets set from the shore on the south coast of WA, however their broad diet means the risk of direct competition is limited (Shaughnessy, 1999). Kailoa *et al* (1993) note that migrating schools of WA salmon in WA and SA waters are prey to both great white (*Carcharodon carcharias*) and grey nurse (*Carcharias taurus*) sharks, both of which are protected species under the EPBC Act. Neither of these species is likely to be solely dependent upon WA salmon as a food source.

The fishing gear generally is not regarded as posing a significant risk to the physical environment. The fishing operation involves drawing the seine net across the sea floor, but as fishing takes place on sandy, moderate to high energy surf beaches which usually have little or no vegetation, impact on benthos is minimal. The use of vehicles (4WDs, tractors) on beaches to haul the nets would be expected to have potential impact on the beaches, although the submission indicates that the beaches used are of hard-packed sand and little dune damage occurs. Furthermore, the south coast salmon fishery is confined to specific beaches, and fishing operations in the south west fishery also tend to be confined to particular beaches, thereby restricting the distribution of impacts.

Given the labour-intensive nature of the fishing operation whereby the net is set from a boat and hauled to the shore, there is little risk of nets becoming lost and as a consequence little danger of ghost fishing.

DFWA indicates that translocation of organisms on vessel hulls is unlikely to be a risk, as the Leeuwin Current flows along the WA coastline transporting biological material. DEH notes that, although the Current has a southward and eastward flow and there would be potential for organisms to be transported by vessel hulls moving in the opposite direction, boats used in these fisheries work in a restricted area and are unlikely to form a serious vector for translocation.

Management response

The main management measures that will minimise the risk of significant impact of fishing on ecosystems and their components in the fisheries are those that manage impacts on the target species. DEH notes that the management measure aimed at ensuring a significant biomass of the target species remains unfished should minimise the risk of an adverse impact on predator and prey species alike. DEH further notes that there are no specific decision rules regarding the ecosystem impact of the fisheries, nor are any proposed. DFWA undertakes to review management arrangements if studies indicate an increased risk. As the monitoring regime is exclusively focused on target and byproduct species, DEH has concerns that the management agency may not be in a position to identify change in a timely manner. Nonetheless, DEH concurs that minimal interaction levels are likely to continue if current effort levels are maintained or reduced. DEH has recommended the development of a management objective to minimise impacts on the marine environment (Recommendation 4).

DFWA proposes additional research to assess the trophic impacts of fisheries at a regional level (to identify any detectable changes in community structures). Although the design parameters of this research are not available, the results of such investigations should improve knowledge of the impact of fishing in the salmon fisheries, as well as other fisheries. DEH encourages DFWA to pursue this area of research to support the objective of minimising impacts on the marine environment.

Conclusion

DEH considers that the fishery is conducted in a sufficiently precautionary manner to minimise the impact of fishing operations on the ecosystem generally. Recommendations have been developed to ensure that the risk of significant impact by the fishery on the marine environment generally is minimised in the longer term.

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LIST OF ACRONYMS

CAES	Catch and Effort System (WA)
DEH	Commonwealth Department of Environment and Heritage
DFWA	Department of Fisheries, Western Australia
EPBC Act	*Environment Protection and Biodiversity Conservation Act 1999*
ESD	ecologically sustainable development
MARPOL	International Convention for the Prevention of Pollution from Ships
MSY	maximum sustainable yield
PIRSA	Primary Industries and Resources South Australia
RFAC	Recreational Fishing Advisory Committee
SA	South Australia
SARDI	South Australian Research and Development Institute
WA	Western Australia