

**DEVELOPMENTAL FISHERIES
MANAGEMENT PLAN**

**FISHERIES DIVISION
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENT**

JELLYFISH
(Catostylus mosaicus)

2003 - 2005

October 2002

**Fisheries Victoria and the Marine and Freshwater Resources Institute
Department of Natural Resources and Environment
VICTORIA**

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1.0 INTRODUCTION

1.1 Aims of the Plan

The aims of this Fisheries Development Plan are:

- to ensure the conservation of *Catostylus mosaicus* in Victorian waters;
- to provide the basis for legislation to restrict access to this fishery by species, fishing method and geographical area;
- to establish a suitable regulatory regime and ensure orderly development of the fishery, which will include continual monitoring and assessment.

1.2 Period of the Plan

This plan will run for 3 years from November 2002 to November 2005 for fishing seasons 2003 to 2005. The fishery will be open for experimental/developmental purposes between February and June of each year. The closing month of June may be extended depending on evidence (growth data from log books) which suggests that optimal growth may not have occurred due to variable weather and other environmental factors.

1.3 Statutory Basis

The plan is a summary of the provisions of the **Fisheries Act 1995** (the Act); in particular section 28(6) which relates to fishery management plans and conditions placed on the permit (section 49). Permit conditions will include an agreement to abide by the provisions of this plan.

2.0 DEFINITION OF THE FISHERY

2.1 Fishery Name

The fishery is referred to as the VICTORIAN JELLYFISH FISHERY, (the fishery).

2.2 Principal Species

The only species the permit holder will be allowed to retain for sale under any permit issued subject to this management plan will be the edible jellyfish, *Catostylus Mosaicus*. A minimum wet bell diameter of 23 cm will be allowed to be harvested.

2.3 Management Boundaries

These management arrangements extend to all *Catostylus mosaicus* found in Victorian waters.

2.4 Geographical Boundaries

The geographical boundaries of the proposed restricted fishery are for Port Phillip Bay, Western Port Bay, Corner Inlet and Gippsland Lakes only. These are prescribed waters of Victoria. Following further stock investigations Fisheries Victoria may approve the opening of other geographical boundaries.

2.5 Jurisdiction

The proposed restricted fishery falls wholly within the jurisdiction of the Victorian Government.

3.0 AUTHORITIES

3.1 Management Authority

Fisheries Victoria (Department of Natural Resources and Environment) is the management authority and has responsibility to oversee routine administration and progress of the fishery.

3.2 Research Authority

The Marine and Freshwater Resources Institute (MAFRI) is the research authority.

3.3 Compliance Authority

Fisheries Victoria Compliance Branch is the compliance authority with responsibility to enforce the provisions of the **Fisheries Act 1995**.

4.0 FEATURES OF THE FISHERY

4.1 Catch Composition

The species is easily targeted and by-catch of other commercial species is not anticipated. By-catch of other jellyfish species will be monitored by the permit holder as a condition of the Section 49 permit.

4.2 Fishing Methods

Catostylus mosaicus can be captured by hand dip-netting from vessels only. The use of a seine net (no greater than 250m in length and mesh size no smaller than 10cm) may be used for herding and corralling purposes only. All fishing gear must comply with the provisions of the appropriate net regulation under the Fisheries Act 1995, and may only be used in accordance with existing management policies, plans, rules or regulations governing other species, area or gear specific fisheries.

Fishers (harvesters) will be limited to existing licensed commercial fishers and will fish from existing licensed vessels under sub-contracted arrangement with the Section 49 permit holder (see Section 6.1). It is anticipated that this operation could generate sufficient return to attract fishers to mix this fishery with their current operations.

4.3 Capitalisation

It is anticipated that up to 5 boats will be used either through lease arrangement or special purpose capital acquisition. To date over \$500,000 has been expended in developing packaging, securing processing equipment and ingredients, training staff and developing harvesting capacity. The permit holder will organise and carry out all processing.

4.4 Relationship with other Fisheries

It is anticipated that fishers may choose to operate in this fishery if economic returns are anticipated to be reasonable. Due to the highly seasonal nature of the fishery it is expected that fishers will sub-contract their expertise as a supplement to their existing fishing activity.

Fishing operations under this permit will not take precedence over any other established fishing operation. Where conflict arises the local District Fisheries Officer will adjudicate. Jellyfish by-catch is significant in a number of fisheries; a change in the way this by-catch is handled may result from this fishery operating.

4.5 Catch Value

The catch value of the maximum developmental fishery Total Allowable Developmental Catch (TADC) (see Section 5.6) depends on the grading of the catch into high value and low value product (depends on size texture). The current wholesale price ranges from \$13,000 to \$16,000 per processed tonne. If the recovery rate is 14% then 210 processed tonnes (bells) could be produced from the TADC (see 5.6) valued in the order of \$2.7 million to \$3.4 million.

4.6 Fleet Composition

The fleet composition is not yet established for a fully exploited TADC; however, it is anticipated that a range of vessel sizes will be used ranging from 5 to 15 metres, consistent with the method adopted by the permit holder.

4.7 Employment

The fishery will generate additional employment in the handling and processing sectors and will provide an opportunity for reduction of competition between fishermen. Employment of full time harvesters and processors is in the order of 17 – 20 in a full TADC year.

4.8 By-catch

Jellyfish can be directly targeted (size and colour) and are readily caught by purpose built dip-net to ensure minimal damage. There will be no by-catch of other species. The use of the seine net for corralling purposes will not effect other species as only jellyfish of particular characteristic are targeted.

5.0 MANAGEMENT RULES

5.1 Entry Criteria

One (1) developmental permit is currently being issued to **David Glory Group Pty Ltd.** (expiry date November 2005). This permit may be reissued under **Fisheries Act 1995** if it is determined that more time is required to ascertain whether a commercial fishery can be proclaimed. Harvesting capacity will be sub-contracted by the permit holder to appropriate fishers. Associated permits to allow fishers to harvest jellyfish will be issued by Fisheries Victoria.

5.2 Criteria for Continued Access

This developmental fishery plan has a 3 year duration (fishing seasons 2003 – 2005). No guarantees are given by this Developmental Fishery Management Plan with regard to future access.

If a commercial fishery is proclaimed following the successful completion of this Plan then a Total Allowable Commercial Catch (TACC) will be established and quota will be auctioned in determined units.

5.3 Administrative Mechanisms

The Section 49 permit will be issued by Fisheries Victoria for 3 years. The permit may be withdrawn at any time by notice in writing signed by the Director of Fisheries Victoria pursuant to Section 49(8) of **Fisheries Act 1995**. The permit is non-transferable.

5.4 Vessel and Gear Rules

All vessels used will be licensed under the Act. Any net used must be registered. All gear must be in accordance with the provisions of this plan, and the appropriate regulation under the **Fisheries Act 1995**.

5.5 Area and Time Closures

Harvesting will be limited to Port Phillip Bay, Western Port Bay, Corner Inlet and Gippsland Lakes only. Harvesting under the plan will be limited to the months February to June inclusive. An extension of past June may be permitted if growth rates indicate further development in July.

5.6 Compliance and Enforcement

A detailed log book will be submitted on a fortnightly basis to MAFRI and will include the following details:

- Weight caught (total wet weight including tentacles). Average weight and size, and
- Geographic position and time, and
- Observance of other species or other occurrences that reveal interactions with the environment.

The penalty for failing to observe a condition of the permit (eg. net specifications, catching method, logbook submission) will be non-renewal of that permit in addition to any other penalty prescribed or otherwise provided for by condition of the permit or by current legislation. Any breaches of fisheries legislation may be cause for the Director of Fisheries Victoria to cancel or suspend any permit issued under this plan.

5.7 Management Priorities

Management priorities for this fishery are to ensure that the fishery is developed in an orderly manner with due regard for all user groups, the environment and the sustainability of the resource. This will be achieved through the use of management controls involving a quota mechanism supported by licensing, and gear and area controls.

6.0 EFFECTS OF DEVELOPMENTAL FISHING

6.1 Stock Assessment

The results of the most recent stock assessments 2001 and 2002 suggest that the average commercial biomass (greater than 23 cm in bell diameter) (95% confidence) in Port Phillip Bay is 10,000 wet tonnes. It is therefore recommended that the annual developmental harvest of **1,200 tonnes** will not significantly impact on sustainability. Each of the other geographical areas: Western Port and Corner Inlet and Gippsland Lakes have been assigned **100 wet tonnes** as a preliminary developmental fishery take.

Due to the high level of annual variation in abundance, a stock assessment will be carried out each year (two times per season – February and May) in Port Phillip, Western Port and Corner Inlet and Gippsland Lakes .

6.2 Total Allowable Developmental Catch (TADC)

The TADC will be set at 1,500 tonnes (wet whole weight) for the first year (2003) of this plan. An adaptive management strategy will be adopted and biomass estimations will be used in future years to determine the TADC.

Each of the 4 bays and inlets will be treated as discrete fisheries at this stage. The TADC for each of these is shown in table 1 below:

**Table 1: TADC (wet whole weight) (2003)
Victoria's Designated Bays and Inlets**

Fishing Area	TADC (Wet Tonne)
Port Phillip Bay	1,200
Western Port Bay	100
Corner Inlet	100
Gippsland Lakes	100
TOTAL TADC	1,500

Port Phillip Bay has been shown through preliminary stock assessment research carried out by MAFRI to be more abundant in stock conglomeration than other Bays and Inlets. Therefore the bulk of the TADC will be harvested there. The small amounts (100 wet tonnes or 14 processed tonnes) allowed to be taken from the other three permitted areas are conservative estimates and will assist in logbook data to be included in overall stock assessments of the Bays and Inlets.

6.3 Impact of Commercial Fishers

Harvesting methods will be by dip netting only which will have minimal impact on the environment or conflict with other activity as jellyfish tend to swim at the surface leaving little space for anything else.

There is no identifiable conflict with recreational fishers as a direct result of this plan. It is anticipated that this fishery will have no negative impact on the viability of existing fishing operations, nor the processing, wholesale or retail sectors of the fishing industry.

6.4 Environmental Impacts

Little research has been done on the environment impact of removing jellyfish from the environment, and its effects on other sea life. A preliminary study will be carried out during the period of the Plan to determine the ecological impacts of harvesting and included in the report of the period.

The impacts of environmental conditions will also be investigated to determine impacts on recruitment. The monitoring of bycatch and benthic disturbance will be carried out during the period of the Plan to determine the suitability of the fishing technology engaged in harvesting.

6.5 Pollution Issues

The harvesting of jellyfish will not raise any significant pollution issues. Where these are identified, modification of permit conditions may be made to the permit holder, in writing.

The disposal of tentacles will be carried out at sea by grinding the tentacle waste and appropriate disposal in deep water.

6.6 Other Species

It is not known whether any of Victorian commercial fish species feed on jellyfish; some evidence exists that jellyfish act as fish attraction devices (FADs) to juvenile fin fish and may influence their geographic distribution. Jellyfish are reported as being voracious predators of zooplankton, fish eggs and fish larvae.

It is unclear what impact the removal of *C. mosaicus* would have on the mix of fish species within Victorian Bays and Inlets. Data collected by the permit holder will assist in the establishment of a broader knowledge base in this regard.

6.7 Community and Regional

The impact of this fishery on community and regional economics is presently unknown; however, no adverse impacts are foreseen and there are potential benefits from handling, processing, transport and exports.

7.0 RESEARCH

7.1 Data Gathering

A logbook will be compulsory and accurate detailed completion by harvesters will be a condition of the permit. The permit holder will forward fortnightly log sheets to MAFRI for incorporation into order of magnitude biomass estimation research. Logbooks will provide details of catch and effort, location and size-frequency of the catch.

7.2 Current Projects

MAFRI is currently monitoring the biomass (using improved stock assessment techniques) in Port Phillip Bay and determine an order of magnitude estimate of stock abundance over the 3 year period in order to ascertain annual fluctuations. Further biomass estimates will be carried out in Western Port, Corner Inlet and Gippsland

Lakes to ascertain order of magnitude estimates of biomass. This research will be available early next year.

7.3 Research Priorities

Preliminary investigations (in collaboration with Food Science Australia) have been carried out on perfecting the processing method to ensure that the highest export grade is attained. Further work is still required in this area.

With regard to the ecological impact of harvesting, the following areas will be investigated in collaboration with MAFRI.

- Monitoring by catch and reporting other species in areas of conglomeration
- Investigate the diets of jellyfish and draw inferences as to the effects of jellyfish removal on populations of prey species.
- Reproduction and polyp stage dynamics.

This research will be completed by 2005 following the completion of the Developmental Fisheries Plan.

Other projects that could be considered include investigating the impact of environmental conditions on the magnitude of recruitment and the relationship between *C. mosaicus* and the eco-systems in Victoria's bays and inlet.

Annual update reports on these investigations will be produced and submitted to EA for consideration.

8.0 EFFORT REDUCTION

As this is a developing fishery no consideration is necessary at this time. Significant damage to jellyfish occurs through a wide range of other fishing operations and it may be appropriate to recommend a range of controls to reduce incidental jellyfish mortality through fishing operations, at some time in the future.

9.0 CONSULTATIVE MECHANISM

Peak bodies (Fisheries Co Management Council and Seafood Industry Victoria) have been consulted on the development of this plan. A Developmental Fisheries Report has been prepared (see attached) that outlines the developments over the last 4 years.

10.0 PERFORMANCE INDICATORS

The main performance indicator for the fishery during the three year period of this plan will be:

- catch and effort
- size constancy
- economic viability
- export and import competition.

A review will be conducted each year as to the ecological sustainability of the developmental fishery. This review will include analysis of stock abundance, stock quality, processing quality and socio-economic implications.

11.0 FEES

11.1 Management Committee Levy

Where the Minister forms a management committee a fee may be raised against the permit holder to cover the cost of any meetings held.

11.2 Research Levy

The fishing permit fee will may include a levy which will be allocated to research.

11.3 Royalties

Proposals for any future resource rental charge (community return) will be made following a Fisheries Victoria response to appropriate policy development.

12.0 MINISTERIAL DISCRETION

The Victorian Minister for Resources and Energy (The Minister) has discretion in all matters relating to the management of the fishery. The Commonwealth Minister with responsibility for Environment Australia has jurisdiction over the issue of export licenses.

**DEVELOPMENTAL FISHERY REPORT
ON THE
JELLYFISH FISHERY
(*Catolstylus mosaicus*)
IN
VICTORIA (1999 – 2002)**

October 2002

**FISHERIES DIVISION
DEPARTMENT OF NATURAL RESOURCES AND ENVIRONMENT**

1. Background

Dried jellyfish (sold mostly in dried discs of 30 – 40 cm in diameter) is a highly regarded food item in many Asian countries, especially in Japan where it is considered to be a delicacy. Traditionally, jellyfish are a food source comprising low fat and high protein qualities, which are recognised for their health qualities. The basis of quality assessment is on size, texture, colour and especially in Japan the crunchiness of the dry salted product.

The Chinese and Japanese jellyfish markets are currently supplied with catch taken in Thailand, Malaysia and China, but increasing demand has created opportunities for Australian involvement. Market research indicates a shortage in both Chinese and Japanese markets and importers could accept 1000 processed tonnes (10,000 wet tonnes) at USD \$8-10 (AUS \$13 - \$16) per wholesale processed kilo (Grade B product). The demand for jellyfish product is growing by 25% per annum.

The Rhizostome jellyfish *Catolstylus mosaicus* is an Australian (Eastern and Northern seaboard) native species and is often found in large numbers in Victoria's bays and inlets. This species has been shown through marketing trials carried out by David Glory Group Pty Ltd to be acceptable to the Asian market.

Estimates indicate that several thousand tonnes can be taken during some years from Port Phillip, Western Port and Corner Inlet. The developmental fishery was activated in 1999 following the release of the report titled "*Feasibility Study for the Development of a Commercial Jellyfish Fishery in Port Phillip Bay, Victoria, MAFRI, (November 1997)*". The report indicated that in Port Phillip Bay alone there is a biomass of *C. mosaicus* ranging from 5,000 to 30,000 tonnes during the summer and autumn months from February to June.

More recent MAFRI research (see Section 4 for more information) suggests that the abundance is extremely variable. In 2001 the commercial biomass ranged from 7,500 wet tonnes to 17,000 wet tonnes. In 2001 this was down by 80%. Initial indications are that the species was most abundant in Port Phillip Bay and Corner Inlet. Stock abundance are likely to be connected to water temperature and salinity.

Figure 1 below shows a freshly caught jellyfish from Coorio Bay in January 2001.

Figure 1: Freshly caught jellyfish ready for processing



2. Developmental Fishery Permit

A developmental permit was issued to The David Glory Group Pty Ltd (DGG) in April 1998 for three years and was extended for 1 year to November 2002. The permit permitted to carry out developmental harvesting (1500 wet tonnes) in Port Phillip Bay, Western Port Bay and Gippsland Lakes, processing and market trials.

Despite stock setbacks due to poor recruitment, DGG has been active in preparing processing sites and developing packaging and export markets. DGG has established an operational arm - David Glory Seafood to further develop, research, harvest and process jellyfish product in Australia.

To date DGG has spent over \$500,000 has been spent in developing the necessary requirements for the commercial operation of the fishery. DGG has established processing plant (Geelong) and equipment and materials, harvesting equipment, fishing fleet and dedicated personnel (local and Chinese specialists).

DGG was successful in harvesting and processing jellyfish in an operation in the Northern Territory. DGG has proved that jellyfish harvesting and processing can be successful in Australia. At the same time a number of potential clients obtained evidence that DGG can provide high quality Australian Jellyfish product.

Figure 2 below shows the processed product that has proved to be acceptable to the Asian market.

Figure 2: DGG Personnel and potential importer sample processed Jellyfish



3. Progress of Developmental Fishery

(a) 1999-2001

The 1999 season (February to May/June) produced a small amount of specimens (150 k/g wet whole weight) which was used to develop a HACCP Plan and carry out microbiological analysis (analysis carried out by Food Science Australia). Processed jellyfish was taken to Japan for market trialing and was given a B grade rating by the importer. The 1999 and 2000 seasons were poor (slow growth rates to minimum of 33cm and dispersed stock abundance) due to dry summers. Only a small amount 200 klgs (wet whole weight) was taken and processed for further export sampling.

Harvesting methods will be by dip netting only (the use of a seine net may be used for herding and corralling purposes only) which will have minimal impact on the environment or conflict with other activity as jellyfish tend to swim at the surface leaving little space for anything else. There is no identifiable conflict with recreational fishers as a direct result harvesting. It is anticipated that this fishery will have no negative impact on the viability of existing fishing operations, nor the processing, wholesale or retail sectors of the fishing industry.

The impacts of environmental conditions will also be investigated to determine impacts on recruitment. The monitoring of bycatch and benthic disturbance will be carried out during the period of the Management Plan to determine the suitability of the fishing technology engaged in harvesting. The harvesting of jellyfish will not raise any significant pollution issues. The disposal of tentacles will be carried out at sea by grinding the tentacle waste and appropriate disposal in deep water.

The 2001 season was again a poor for jellyfish and only a small amount was caught (200kgs) which was processed and used as samples. The poor season was most likely due to continuing dry conditions, but the company remains committed to the project and will try large scale harvesting again in the coming summer.

(b) 2002 Season

An expanded Developmental Fisheries Management Plan was prepared and approved by Environment Australia for the 2000/01 - 2001/2 period. The Developmental Fisheries Management Plan (2001-2) has included in it two amendments from the previous Developmental Fisheries Management Plan for the fishery. These include the following:

- The capacity to fish in Western Port Bay, Corner Inlet and Gippsland Lakes (given a suitable stock assessment analysis from the MAFRI/FRDC research project). This inclusion is to ensure that a full Total Allowable Developmental Catch (TADC) of 1500 wet whole weight can be processed and used in extensive market testing. Again this TADC may be varied in the second season according to new estimates from the MAFRI biomass study.
- The use of a seine net for corralling purposes. This is necessary to make the harvesting process economically viable. Capture will be by selective dip netting. No by catch will be caught or damaged during the process of corralling. Jellyfish occur in large conglomerations and other species usually avoid being present. The corralling process will increase catch per unit effort and make harvesting more economically viable.

The Developmental Fisheries Plan (DFP) expired in April 2002 and a new DFP is currently being developed for submission to Environment Australia in order to get an export approval under section 303FN of the *Environment Protection and Biodiversity Conservation Act 1999*.

4. Research

MAFRI has been conducting a stock assessment project over the last 3 years (2000 – 2002) under a grant from the FRDC. The abundance and biomass were assessed using a stratified random sampling scheme with size frequency samples taken by dip net. Estimates were made of commercial biomass (bell diameter of 23 cm or more).

Table 1 below indicates the estimates of abundance (95% confidence level)

Fishing Season (January to June)	Estimated Commercial Biomass (wet tonnes)
1997	30,000
1998	
1999	
2000	-
2001	17,000
2002	3,000

Indications are that the stock biomass is extremely variable with some periods devoid of stock altogether. The reasons for this could be due to water temperature and/or salinity. The last two years could have yielded the TADC of 1,500 wet tonnes but tracking conglomerations is proving difficult. Commercial viability will depend on the ability to secure reasonable catches per trip to enable maximum utilisation of processing plant, equipment and staff.

5. Marketing

Demand for the jellyfish product is currently concentrated in Japan, Taiwan, Korea and China where DGG already have established markets. Local demand in these countries by far exceeds domestic production, so all of the dry salted jellyfish is imported. The first country to produce jellyfish for human consumption was China. Several countries in Asia soon followed with Japan are one of the leading consumers although its domestic production doesn't exceed 5% of local consumption.

Malaysia, Indonesia, Thailand, Burma and Philippines export excess of product to above mention markets. With the general shortage of quality jellyfish and increasing demand, the import price remains at a profitable level of around US\$6,800 per dry ton. DGG has established clientele in Japan, Korea, Taiwan and China, who are seeking a reliable source of quality product.

6. Conclusions and Recommendations

DGG is financially and technically ready to commence full fledged commercial harvesting, processing and exporting jelly fish from Port Phillip Bay area as soon as DGG receive positive indication on jelly fish availability in the Bay. Under a limited developmental operation (1500 wet tonnes or 210 processed tonnes) DGG will gain a strong foothold in the market which represents over \$2 million in revenues.

DGG is seeking a further extension and the developmental permit for a period of 3 years (2003 – 2006). According to DGG a number of overseas investors are convinced of the viability of this project and, subject to DGG securing harvesting and processing permits, and are ready to inject additional funds. This will allow DGG to continue with this project on larger scale. Additional to financial backing,

DGG will be in position to employ and train (with the assistance of Chinese experts) additional staff in Victoria.

DGG's bona fide efforts to develop the jellyfish fishery in Victoria is attested by its investment and marketing activities over the last 4 years. It is recommended that DGG be allocated an extension of another 3 years in order to determine whether the fishery has the possibility to become a fully commercial fishery under a quota management system.