REGIONAL LARVAL FISH ARCHIVES: PRESERVATION OF AN IMPORTANT FISHERIES RESOURCE

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AUSTRALIAN MUSEUM

FISHERIES RESEARCH & DEVELOPMENT CORPORATION

Project 94/055

NON TECHNICAL SUMMARY

94/055. REGIONAL LARVAL FISH ARCHIVES:
PRESERVATION OF AN IMPORTANT FISHERIES RESOURCE

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OBJECTIVES:

The overriding objective of this project was to incorporate preserved larval fish samples from previous fisheries-relevant studies into Regional Larval Fish Archives (RLFAs) where they will be maintained for future needs of fisheries researchers and managers.

NON TECHNICAL SUMMARY:

With FRDC support, Regional Larval Fish Archives (RLFAs) have been established at the Australian Museum, CSIRO Fisheries in Hobart, the Museum of Tropical Queensland, the Museum of Victoria and the South Australian Museum. In the RLFAs large larval fish collections can be deposited to be held against future need. Archived larval fish samples represent an extremely valuable resource, one that cost several million dollars to acquire. A huge amount of "potential data" has been saved at the very low cost of incorporating these larval fish collections into the RLFAs. These samples are now available for study by bona fide researchers for fisheries purposes.

KEYWORDS

larvae, archive, fisheries, data

BACKGROUND

Studies of larval fishes are often the best way to provide many types of information of great value to fishery biologists and managers of fisheries. These include location of spawning grounds in space and time, determination of habitats used (and required) by fish during their larval phase, fishery-independent estimates of stock size and stock boundaries, discovery of new fisheries, feeding habitats of larvae, condition of larvae, insight into recruitment fluctuations, and historical changes in all of the above. The methods used to sample fish larvae are unselective in terms of the species they catch, so any larval fish sampling program will catch an extremely wide variety of species. This means that a program aimed at, say, whiting will also have sampled snapper, bream, trevally, in fact virtually all the species with larvae in the area at the time the sampling took place.

Preserved samples of larval fishes constitute a valuable source of "potential data" on a wide variety of species of considerable interest to both recreational and commercial fisheries. Typically, a research program is targeted at one or a small group of species, and rarely, if ever, is all the information of interest to fisheries biologists and managers extracted from the samples during the program. Further, new questions continually arise. Therefore, it is critical that the preserved samples be archived at the end of the program to be available in the future when questions arise about other species not studied in the original program, or other aspects of the biology of the original target species. It is much cheaper to archive these samples than to re-take and process them, and in any case, they constitute an irreproducable "snapshot" of conditions at the time of the study. The CalCOFI program off the US west coast is a good example - the archived samples are returned to time and time again as new questions arise or further information is required. Closer to home, members of the FRDC-funded project "Ichthyoplankton-based analysis of spawning distribution and stock structure of temperate Australian finfish", recently attempted to locate some preserved larval fish samples taken in the 1970s and 1980s to assist in their research goals. Some samples were found (in one case in the garage of the person who took them as a graduate student!), but others, with their irreplaceable potential data, could not be found and must be presumed lost.

NEED

In the past few years, many larval fish research projects have been undertaken in Australia (Table 1). Larval fish samples have been taken for fisheries research, for environmental research (eg. Sydney sewer outfalls), and for ecological research. Before the establishment of the Regional Larval Fish Archives a large number of such preserved samples were sitting on the shelves of laboratories (and garages) in Australia. These larval fish samples were acquired, sorted and identified at great effort and expense. They had then served the original purpose for which they were taken, and were then considered surplus (in the short term). However, they still contain a great deal of unextracted information. The country cannot afford to lose these preserved samples that cost several million dollars to obtain.

It is vital that larval fish samples be adequately curated and made available for future needs. However, the universities and other research institutions that host such studies do not have the space, expertise, resources, interest or brief to do this. As has often happened in the past,

valuable and irreplaceable samples are in danger of being destroyed either actively (being thrown away) or through neglect. Samples lost in this way include those from the Warm-Core Eddy program off NSW and the Great Australian Bight program, both of the late 1970s - early 1980s, and both of relevance to current fisheries research and management issues.

The larval fish research programs listed in Table 1 would have cost several millions of dollars if one takes into account the real and total costs of the taking (ship time, fuel, equipment, salaries, etc) and processing (lab space, microscopes and other laboratory equipment, salaries, etc) of the samples. The larval fish portion of the "DOOM" study of the Sydney sewer outfalls alone cost $1000000. Australia and its fisheries cannot afford to lose these valuable samples and their potential data. The funds granted in the current project have ensured that the samples from these expensive research programs have been properly archived at a very small fraction of the cost of the programs. In the case of the DOOM study, for example, it cost only $7,000 to incorporate the samples into the Fish Collection of the Australian Museum, less than 1% of the cost of the original research program.

OBJECTIVES

The overriding objective of this project was to incorporate preserved larval fish samples from previous fisheries-relevant studies into Regional Larval Fish Archives (RLFAs) where they will be maintained for future needs of fisheries researchers and managers. In the RLFAs large larval fish collections can be deposited to be held against future need. Archived larval fish samples represent an extremely valuable resource, one that cost several million dollars to acquire. A huge amount of "potential data" has been saved at the very low cost of incorporating these larval fish collections into the RLFAs.

These samples are now available for study by bona fide researchers for fisheries purposes.

With FRDC support a number of Regional Larval Fish Archives (RLFAs) were to be established. Large larval fish collections were to be deposited in the following RLFAs to be held against future need:

- Australian Museum in Sydney for NSW waters;
- I.S.R. Munro Fish Collection at CSIRO Fisheries in Hobart for Tasmanian waters and CSIRO collections;
- Museum of Victoria for Victorian waters; and
- South Australian Museum for South Australian waters.

Unfortunately, the Queensland and Western Australian Museums were unable to participate in the RLFA program so larval fish collections from these states went to the Australian Museum which already houses by far the largest larval fish collection in the country. In some cases, especially when the researcher who took the samples is based in one state but conducted larval fish research in another, the samples may be deposited in an RLFA other than indicated above.

METHODS

The State Museums (for the purposes of this proposal, this includes the I.S.R. Munro Fish Collection of CSIRO) were the ideal places for these samples to be stored and curated, and made available for future study. Incorporation included entering data on computer data bases, proper labelling and documentation and transferring the larvae into the proper preservative for long-term storage so the samples can be readily available in the future. This was person-power intensive, and with the considerable backlog of larval fish samples in universities, research institutes and garages that were waiting to be incorporated, this incorporation represented a considerable cost to the state Museums, one they were ill-equipped to bear.

The identified backlogs of samples (Table 1) were incorporated into the RLFAs within two years using FRDC funding. For administrative simplicity, the grant was made to the Australian Museum which then distributed funds to the other RLFAs at the state museums (on a subcontract basis). All planning for future larval fish sampling projects should include deposition of the samples in the RLFAs, and must allow some funding (or at least person-power) to achieve this.

A manual on proper storage and handling of larval fish collections was prepared by the Australian Museum, the institution with the greatest experience in curation of fish larvae, to ensure that all RLFAs were up to standard and that the collections they hold are in good condition. This was important because some of the proposed RLFAs had little or no experience with fish larvae, and will be available should other state museums subsequently establish new RLFAs.

The larval fish samples incorporated into the RLFAs have met minimum criteria to ensure that only collections of potential use for fisheries research were accepted. The most important of the criteria are that the samples are quantitative, and that there are adequate data associated with them. Minimum data required include date, time and location of sample, a measure of volume sampled or distance travelled by the sampling device, type of sampling device, (including dimensions and mesh size), tow speed (if applicable), sampling protocol (eg. surface tow, oblique tow, etc.). All the larvae from each sample had to be deposited - this was the only way to ensure the samples are quantitative, and thus truly useful for future fisheries research. The main sampling programs that met these criteria and information about them relevant to this proposal are listed in Table 1.

DETAILED RESULTS

Five Regional Larval Fish Archives have been set up as follows:

- **Australian Museum RLFA** comprises eleven collections (2574 stations, which contain over 351,500 specimens). These collections have all been entirely processed and are available to researchers.

- **CSIRO Division of Fisheries Research RLFA** contains nine collections, the majority of which are fully processed. The collections that are not fully processed will be completed in the near future. All collections are accessible to researchers.

- **Museum of Victoria RLFA** comprises one large collection that has been entirely processed, and is available to researchers.

- **South Australian Museum RLFA** contains two of collections, one from St Vincents Gulf and one from Spencer Gulf. These have been entirely processed, and are available to researchers.

- **Museum of Tropical Queensland RLFA** The samples (2 AIMS collections) have been acquired at the MTQ RLFA. They were in poor condition and required rehydration and rejarring. At this stage the collections have not been fully registered but a short term employee has been lined up to complete the registration of the collections. Even in their currently unregistered state, the collections are accessible to researchers.

The full details of all the collections incorporated into Regional Larval Fish Archives are shown below in Table 1.

TABLE 1. Summary of the collections incorporated into the Regional Larval Fish Archives.

STATE / ENVIRONMENT	NUMBER OF SAMPLES	% ASSEM-BLED IN RLFA	% AVAILABLE FOR RESEARCH	% OF STATION DATA ON COMP-UTER	% OF SAMPLES FULLY PROCESS-ED	CURRENT RLFA LOCATION
Qld/coastal (GBR Lagoon off Lizard Island) - Leis	78 (Note 1) (100)	100%	100%	100%	100%	**AM**
Qld/coastal-oceanic (GBR / Coral Sea) - Suthers	574 (574)	100%	100%	100%	100%	**AM**
NSW/coastal-oceanic (Sydney- Brisbane) - Miskiewicz	500 (512)	100%	100%	100%	100%	**AM**
NSW/estuarine(Lake Macquarie) - Miskiewicz	734 (980)	100%	100%	100%	100%	**AM**
NSW/coastal Sydney shelf - Ottway / Gray	912 (756)	100%	100%	100%	100%	**AM**
NSW/est-coastal(central coast) - Kingsford	614 (1000)	100%	100%	100%	100%	**AM**
NSW/estuarine (central coast) - Suthers	0 (Note 2) (140)	100%	100%	100%	100%	**AM**
NSW/estuarine (S-N coast) - Suthers	450 (422)	100%	100%	100%	100%	**AM**
NSW/Surf zone (Sydney beaches) - Leis	464 (464)	100%	100%	100%	100%	**AM**
NSW-Vic/coastal-oceanic - Lanzing	340 (470)	100%	100%	100%	100%	**AM**
WA/coastal-oceanic (S & W coasts) - Fletcher	377 (240)	100%	100%	100%	100%	**AM**
WA/estuarine (S & W coasts) - Neira	782 (782)	100%	100%	100%	100%	**AM**
Tas/coastal-oceanic (east coast) - Jordan	830 (Note 3) (500)	100%	100%	100%	90%	**CSIRO**
SA-WA/oceanic (Great Australian Bight) - Stevens	132 (79)	100%	100%	100%	100%	**CSIRO**

WA/coastal oceanic (S&W coasts) - Fletcher	244 (250)	100%	100%	100%	100%	**CSIRO**
WA/coastal oceanic (NW Shelf) - CSIRO Hobart	355 (355)	100%	100%	100%	100%	**CSIRO**

TABLE 1 (continued) . Summary of the collections incorporated into the Regional Larval Fish Archives.

STATE / ENVIRONMENT	**NUMBER OF SAMPLES**	**% ASSEM-BLED IN RLFA**	**% AVAILABLE FOR RESEARCH**	**% OF STATION DATA ON COMP-UTER**	**% OF SAMPLES FULLY PROCESS-ED**	**CURRENT RLFA LOCATION**
COMBINED PROCESSING OF THE FOLLOWING 5 CSIRO COLLECTIONS. (Note 5)	TOTAL **(Note 4)** 978 (820) stations					
SE Australia (all CSIRO collections) - various CSIRO	(50) **(Note 4)**	100%	100%	100%	70%	**CSIRO**
SE Aust/coastal-oceanic (Ichthyop. project) - Bruce	(250) **(Note 4)**	100%	100%	100%	70%	**CSIRO**
Tas/coastal-oceanic (circum-island) - Thresher	(400) **(Note 4)**	100%	100%	100%	70%	**CSIRO**
Tas/coastal (Storm Bay) - Griffiths	(100) **(Note 4)**	100%	100%	100%	70%	**CSIRO**
Tas/coastal-oceanic (east coast) - Young	(20) **(Note 4)**	100%	100%	100%	70%	**CSIRO**
Qld/coastal (AIMS Transect, GBR) - Williams	60 (60) **(Note 5)**	100%	100%	100%	0%	**MTQ**
Qld/coastal-oceanic (Myrmidon Reef, GBR) - Williams	96 (96) **(Note 5)**	100%	100%	100%	0%	**MTQ**
Vic/estuarine (Pt Phillip Bay) - Jenkins	171 (180)	100%	100%	100%	100%	**NMV**
Tas/estuarine (Derwent River) - Chamchang	(50) **(Note 6)**	0%	0%	0%	0%	-
Qld/coastal (GBR Lagoon off Lizard Island) - Choat	100 (0) **(Note 7)**	0%	0%	0%	0%	-
Vic/estuarine (Corner Inlet) - Jenkins	(61) **(Note 8)**	0%	0%	0%	0%	-
Vic/estuarine (Hopkins River) - Newton	(144) **(Note 9)**	0%	0%	0%	0%	-

SA/est.-coast Adelaide (Spencer & St. Vincent Gulf) - Bruce	80 (80)	100%	100%	100%	100%	**SAM**
TOTAL STATIONS PROCESSED:	8715 **(Note 10)**					
PERCENTAGE OF STATIONS COMPLETED:					96%	

Notes on Table 1:

- Column 1 lists the name of the collection and the original supplier of the collection.

- Column 2 shows the number of samples processed. Figures in brackets are those listed in the original application.

- Column 3 shows that except for material that was not suitable for incorporation into the Archives, and that of Chamchung (see Note 4 below) all material is now assembled at the RLFAs.

- Column 4 shows that all the assembled collections are available now to be used in research programs.

- Column 5 shows that for all incorporated collections 100% of the station data are recorded in computer databases.

- Column 6 shows the percentage of samples fully processed. This includes the individual listing of each taxon lot on the computer.

- Column 7 lists the RLFA that holds the collection.

- Note 1. This collection was not listed in the original grant application but was subsequently substituted for that of Dr J. Choat that could not be found at James Cook University (see Note 7).

- Note 2. This Suthers collection (NSW/estuarine (central coast)) was a joint project with Dr M. Kingsford (NSW/est-coastal (central coast)). The 2 collections have been combined under Kingsford NSW/est-coastal hence the Suthers collection has been entered in the table above as 0 stations.

- Note 3. All the station details have been entered onto databases however no specimens have been entered as Dr A. Jordan did not provide the material until late in the project. Processing of these specimens will be completed under temporary funding from CSIRO concentrating initially on commercial species.

- Note 4. These 5 collections are currently being processed as a block. Reporting on their state of completion as a block gives a more accurate picture. All the specimens have been curated to prevent any deterioration. Approximately 30% of the specimens are still to be

registered. Processing of these specimens will be completed under temporary funding from CSIRO concentrating initially on commercial species.

- Note 5. These collections incorporated into the Museum of Tropical Queensland Larval Fish Archive and are available for research. They are yet to be fully registered. This will occur under supervision of Dr P. Arnold. See attached letter.

- Note 6. This collection was not made available for incorporation by the investigator, Mr C. Chamchang despite the co-investigators being told in good faith that the material would be available.

- Note 7. Dr J. Choat's collection of GBR Lagoon larvae off Townsville was lost at James Cook University (further evidence that the Regional Larval Fish Archives project is important for retaining this valuable material). The co-investigators were told in good faith that the material would be available, but unknown to the researcher, most of the specimens were disposed of during a clean-out of the storage area. This is a hazard for uncurated collections stored at universities. The gear comparison study of Dr J. Leis (Note 1) was substituted for that of Choat because it is highly relevant to fisheries biologists. It was of similar size and from a similar geographic area to Choat's collection. The previous milestone reports listing progress on Choat's collection were in fact referring to Leis' collection.

- Note 8. The Corner Inlet collection was lost at Melbourne University (more evidence that the Regional Larval Fish Archives project is important for retaining valuable material).

- Note 9. In Dr G. Newton's collection the fish larvae were not sorted from the original plankton samples. This collection therefore did not fit the requirements for incorporation of material for the Archive and thus was not included.

- Note 10. The discrepancy between the number of stations listed in the original proposal and those actually incorporated into the Archive results from the following factors:

    - inaccurate estimates given by researchers at the time the proposal was written;
    - double counting of samples by researchers for some collaborative projects;
    - samples lost at original storage site; and
    - samples that were thought to meet the criteria for inclusion in the Archive but did not.

  This net result, is that somewhat fewer stations were incorporated into the Archives than originally proposed, but the total number of lots incorporated into the RLFAs considerably exceeds the number originally proposed. This is because, many of the samples were received in taxon lots rather than station lots. A station lot is all larvae from a particular sample mixed together in one vial. If a station lot is split into separate containers each containing a single taxon, each constitutes a taxon lot. This resulted in a greater work load than originally planned, but results in a more accessible resource for fisheries researchers.

BENEFITS

This is difficult to assess because it depends upon the degree and source of usage of the archived samples to address research and management problems. The percentages are calculated on the basis of the numbers of samples from each State/Territory. Although the Commonwealth benefit is listed as zero, the level of Commonwealth benefits will, in fact, be high because Commonwealth responsibilities in fisheries overlaps many of the geographical regions included in Table 1.

State / Territory	Benefits
NSW	45%
TAS	20%
WA	20%
QLD	10%
SA	3%
VIC	2%
Commonwealth	0%
NT	0%

All finfish fisheries in the areas where samples were taken can benefit from this project. It is not possible to apportion this among the fisheries involved.

INTELLECTUAL PROPERTY AND VALUABLE INFORMATION

The Australian Museum retains the intellectual property rights for all information in its databases and use of this data is by consent of the Australian Museum only.

No commercially valuable information is involved.

FURTHER DEVELOPMENT

An article on the Larval Fish Archives was published in the Newsletter of the Australian Society for Fish Biology 1994 Volume 24, Number 2. A follow-up article will appear in the first ASFB newsletter of 1997. This article will give an update on the article published in 1994. It will emphasise the relevance of the Regional Larval Fish Archives to fisheries scientists, and will provide a full listing of all the collections held in each of the Archives along with contact information for each Archive. It will also urge researchers undertaking larval fish studies relevant to fisheries biology to coordinate with their Regional Larval Fish Archive at an early date so incorporation of their material will proceed smoothly.

Now that the Archives have been established there is incentive to continue to add collections to them. At the Australian Museum, two additional collections, made by Dr J. Leis and Mr T. Trnski have already been earmarked for inclusion.

The Australian Museum Archive has already been used by a number of researchers including two from overseas. The main users were engaged in producing an identification atlas of temperate Australian larval fishes which will be of great use to fisheries researchers.

STAFF

Dr J. Leis and Mr M. McGrouther of the Division of Vertebrate Zoology, Australian Museum managed the project. The following staff managed the incorporation of collections into relevant Regional Larval Fish Archives:

Dr P. Arnold, Museum of Tropical Queensland
Dr M. Gomon, Museum of Victoria
Mr A. Graham, CSIRO Fisheries, Hobart
Mr T. Simm, South Australian Museum

Temporary staff were employed at the Australian Museum (J. Pogonoski), CSIRO Fisheries, Hobart (K. Evans) and at the Museum of Victoria (R. Ickeringill) to process the specimens. One new staff member is soon to be employed at the Museum of Tropical Queensland to complete the processing of the samples. No additional staff were employed at the South Australian Museum.

FINAL COST

The final cost of the project was as follows:

FRDC contribution:

Fin. year	Salaries	Operating	Total
94/95	$40,983.00	$2,345.00	$43,328.00
95/95	$42,212.00	$0.00	$42,212.00
Total	**$83,195.00**	**$2,345.00**	**$85,540.00**

Agency contribution:

Fin. year	Salaries
94/95	$13,600.00
95/95	$9,120.00
Total	**$22,720.00**

Project total:

Fin. year	Project total
94/95	$56,928.00
95/95	$51,332.00
Total	**$108260.00**

Most of the infrastructure required for the state museums to become RLFAs was already extant. Only a small amount of money for equipment and supplies (glassware, preservative, shelving, etc) was required. Some money for shipping of samples from research institutions to RLFAs was required. Most of the FRDC money was used for salary for data input and handling of the samples (including transfer into appropriate preservative, labelling and storage).

DISTRIBUTION LIST

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