Department of Environment and Conservation

Vegetation Health Service

Annual Report 2005-2006

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Phytophthora Detection

1. Introduction

The Vegetation Health Service (VHS) provides a dedicated, specialist scientific service for the detection and identification of *Phytophthora* species from samples associated with the management of the State's forest and conservation estate, logging and mining activities, private industry and research. The VHS is funded by DEC's (formerly CALM) Sustainable Forest Management Division (90%) and Nature Conservation Division (10%). It is run by Science Division staff based at DEC's Kensington Research Centre. Its services are offered free of charge to all DEC and FPC sections and personnel. The service is also available to external clients at a standard fee of $77 (incl. GST) per sample, with special discounted rates applying to Alcoa World Alumina Australia and to Natural Heritage Trust projects.

Samples received by the VHS in most cases include a mixture of soil and plant-root material, which is baited for *Phytophthora* using the *Eucalyptus sieberi* cotyledon baiting method. Bait material is plated to selective agar medium for incubation, and any possible *Phytophthora* colonies that emerge are then isolated to pure culture for identification to species. Where isolation of the pathogen from specific host-plant tissue is required, roots are surface-sterilised and direct-plated to selective agar medium for *Phytophthora* isolation.

Results are supplied to clients as soon as possible. All results (both *Phytophthora*-positive and negative) are added to the VHS database, along with details of sampling location, land tenure, etc. This database now contains 27,529 records (at 30th June 2006), and this information resource is made available to land managers and researchers as required. Representative *Phytophthora* cultures are added to the VHS Culture Collection (see Section 3 below), which now contains 956 cultures. These cultures are made available to researchers, both in DEC and in other institutions, on request.

The VHS also provides advice to assist Departmental staff and also the public with other plant disease problems in forests, plantations, parks and reserves, and nurseries.

2. Annual summary – samples processed

During the 2005-2006 financial year the VHS received 1,489 samples for testing for the presence of *Phytophthora* (Table 1 and Figure 1).

The sources of these samples are as follows:

CALM/DEC – samples sent by CALM/DEC Dieback Interpreters (or by contractors to DEC), and District staff, in fulfilment of DEC's forest and land management responsibilities.

BCI – samples sent by DEC personnel associated with the Biodiversity Conservation Initiative.

ALCOA – samples sent directly by Alcoa World Alumina Australia (or by contractors to Alcoa) in fulfilment of Alcoa's forest management responsibilities prior to, during and after mining activities, on the DEC estate.

PRIVATE – samples sent directly by external clients (land managers or private contractors).

RECOUP – samples for external clients sent by DEC dieback interpreters.

FPC – samples sent directly by the Forest Products Commission, including FPC Nurseries.

NHT – samples associated with projects funded by the Natural Heritage Trust.

CPSM – samples associated with projects carried out at the Centre for *Phytophthora* Science and Management at Murdoch University.

The majority of samples processed by the VHS belong to DEC (CALM). These include samples sent by DEC Dieback Interpreters from DEC-managed forest being monitored for *Phytophthora* in conjunction with logging by the FPC. The reduction of logging in native forest by the FPC has significantly reduced the amount of DEC samples processed in recent years, but there was again a small increase in 2005-06. Processing of samples collected by DEC in the Fitzgerald River National Park (Bell Track), associated with the **Biodiversity Conservation Initiative** (BCI), commenced in May 2006. Samples are also received from various DEC District offices (Table 2 and Figure 2). A contract to process 250 samples (down from 304 last year) for Alcoa's monitoring program for dieback-free rehabilitated mine-pits was secured in 2005-06 [this work was also done in 2002-03, 2003-04 and 2004-05]. Consultants (Glevan Consulting) supplied 209 samples from various sources including DEC land and Alcoa (Table 1 and Figure 1). Samples from two PhD student projects being carried out at Murdoch University were processed this year in the VHS, under the Department's partnership with the **Centre for *Phytophthora* Science and Management**. These samples were collected in the tuart forest (Yalgorup National Park), and on the Northern Sandplains. No samples were received from NHT projects in 2005-06.

Table 1 and Figure 1. Numbers of samples received from major sources, including consultants (Glevan Consulting), in 2005-2006. Total numbers of samples received from the same sources in 2004-2005 are given in the Table for comparison.

Source	No. of samples			
	Received direct	Received via Glevan Cons.	Total 2005-2006	Total 2004-2005
CALM (DEC)	649	25	674	654
BCI	195	0	195	-
ALCOA	250	13	263	417
PRIVATE / RECOUP	11	171	182	155
CPSM	149	0	149	-
FPC	23	0	23	4
NHT	0	0	0	20
TOTAL	**1277**	**209**	**1486**	**1250**

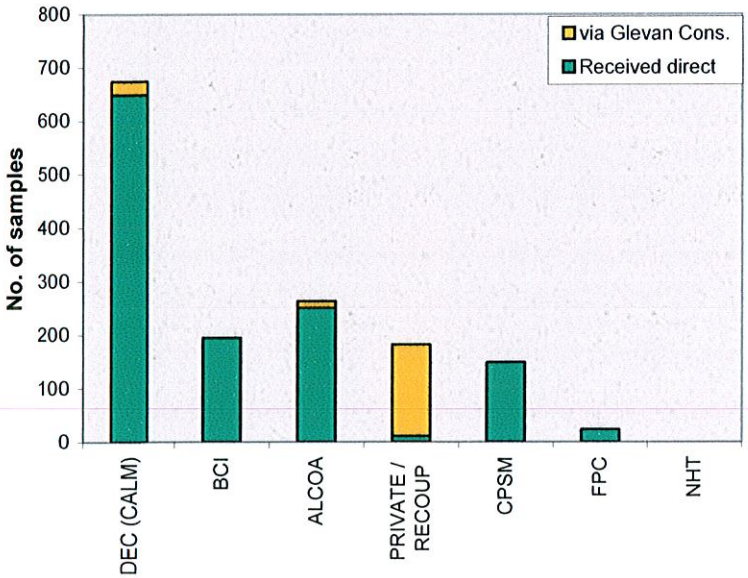
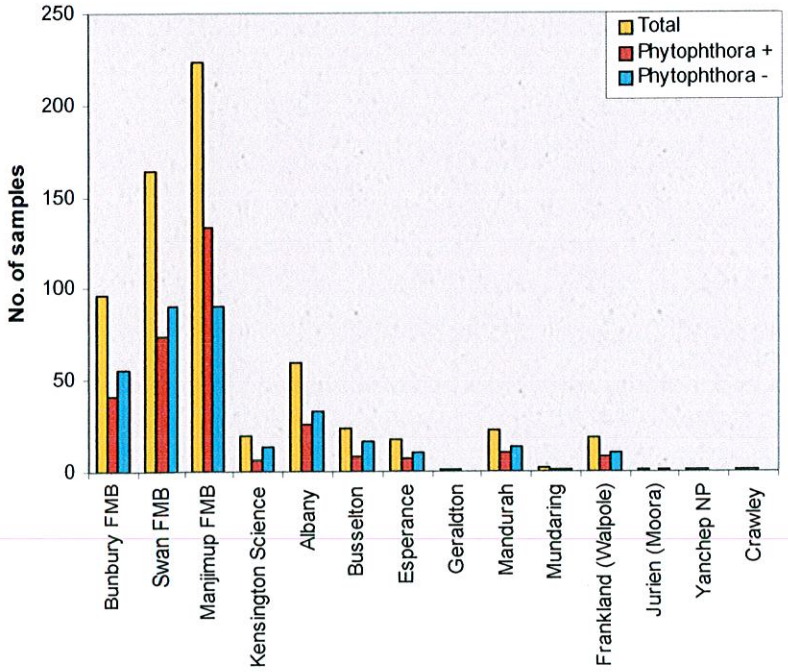


Table 2 and Figure 2 show details of the sources (by District) of DEC (CALM) samples received for the year (including Recoup samples, but excluding BCI samples and DEC samples collected by Glevan). The locations where DEC samples were collected are shown on the attached **Map**, with results broken down to distinguish *P. cinnamomi*, Other *P.* spp., and Negative.

Table 2 and **Figure 2.** Numbers of samples received from DEC (CALM) offices in 2005-2006, and numbers giving positive or negative recoveries of *Phytophthora*. Total numbers of samples received from the same sources in 2004-2005 are given in the Table for comparison.

DEC Office	No. of Samples[1]			
	Total received 2005-2006	*Ph.* Positive 2005-2006	*Ph.* Negative 2005-2006	Total received 2004-2005
Bunbury FMB	96	41	55	184
Swan FMB	164	74	90	143
Manjimup FMB	223	133	90	135
Kensington Science	19	6	13	112
Albany	59	26	33	10
Busselton	24	8	16	0
Esperance	17	7	10	3
Geraldton	1	1	0	4
Mandurah	23	10	13	0
Mundaring	2	1	1	0
Frankland (Walpole)	18	8	10	3
Jurien (Moora)	1	0	1	0
Yanchep NP	1	1	0	0
Crawley	1	1	0	0
TOTAL	**649**	**317**	**332**	**599**

[1]Received direct from DEC office - includes recoups and private, but not Glevan/DEC samples.



3. *Phytophthora* species

During 2005-2006, *Phytophthora* was isolated from a total of 657 samples (Table 3, Figure 3). *P. cinnamomi* was the species most frequently isolated (547 samples). *P. citricola* was isolated from 46 samples, ***P.sp.2*** from 31 samples, and ***P. cryptogea*** from three. One sample yielded both *P. cinnamomi* and *P. citricola*, and one had *P. cinnamomi* and a *P.* sp. Twenty-two *Phytophthora* isolates ("*P.* species") were still to be fully identified to species.

Representative pure cultures of the various *Phytophthora* species isolated, and cultures representing different geographic locations, ecosystems or host plants, or morphological types, were added to the permanent Culture Collection. These cultures are maintained in a pure and viable condition by periodically sub-culturing, checking their purity and establishing fresh storage cultures. The VHS now has 956 cultures in the Collection.

3.1. New *Phytophthora* records and undescribed *Phytophthora* taxa in WA

The adoption and use of DNA sequencing techniques for the identification of *Phytophthora* species is causing something of a revolution in *Phytophthora* taxonomy, worldwide. The availability of these techniques in WA through the **Centre for *Phytophthora* Science and Management** (at Murdoch University) has enabled the routine testing of some of our WA isolates that could not be identified satisfactorily by traditional morphological examination.

DNA sequencing by CPSM has confirmed at least three new *Phytophthora* taxa among unidentified VHS isolates from the south-west. Two of these are undescribed new species ("**P.sp.1**" and "**P.sp.2**"), as noted in the 2004 – 2005 VHS Annual Report; the third was identified as ***Phytophthora inundata*** in 2006. All three have been found associated with dying plants in native forest or heath-land. This year we have obtained preliminary evidence of several additional **undescribed new species** of *Phytophthora* from WA sources, among both recent and historical isolates. Further testing is being done with CPSM to verify this.

An Honours student at Murdoch University (Melissa Bexley) commenced a project in 2006 to examine and describe the "P.sp.2" cultures and investigate their pathogenicity.

We have submitted for publication a research paper on the occurrence of *P. inundata* in association with dying native vegetation in WA. This species was formally named only recently, in 2003. It was first reported in Australia in 2006, from Victoria (Cunnington *et al.* 2006), where it was not associated with plant disease although isolated from soil in horticultural sites. However, in Europe and South America, *P. inundata* is a recognised pathogen of woody trees and shrubs, including *Olea, Prunus, Salix* and *Vitis*. One of the VHS isolates of *P. inundata* was obtained from a dying *Xanthorrhoea* in jarrah forest in 2005; another was from a sample collected in a South Coast national park in 1986.

Despite some strong physical similarities, each of the above three new taxa is genetically quite distinct from the other Phytophthoras found to date in WA, which is cause for concern.

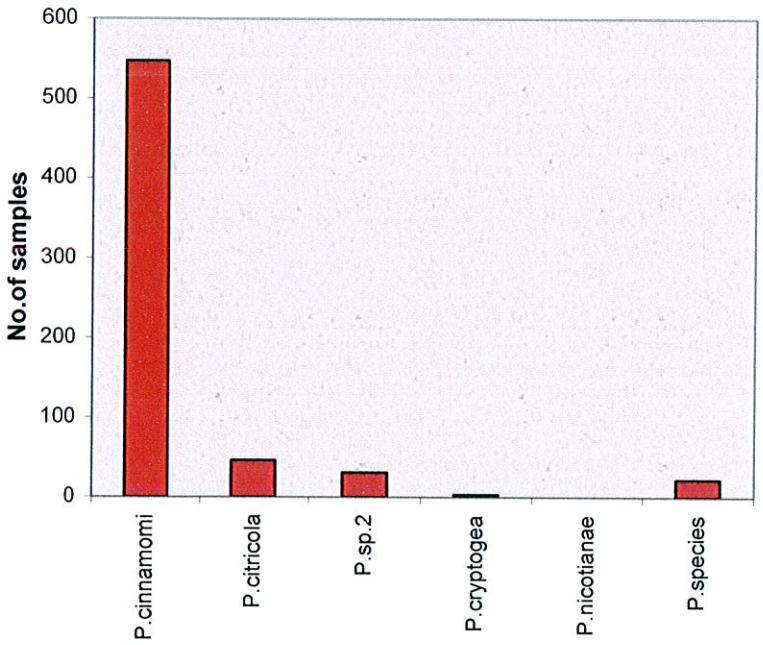
It is imperative that these new Phytophthoras are all properly described and documented as components of our biodiversity. They must also be investigated in detail to determine their host ranges, pathogenicity, distribution, ease of spread, and other characteristics such as their response to the inhibitor, phosphite. An estimate of the **level of threat** that each one poses to our biodiversity is required, so decisions can then be made, based on sound science, as to whether specific management strategies involving intervention are necessary.

Controls applied currently for *Phytophthora cinnamomi* (such as phosphite) may not always be appropriate for new *Phytophthora* species. It is likely that increased levels of human activity in and around infested areas in the short term, together with the consequences of climate change in the longer term, will exacerbate the effects of these Phytophthoras on native flora. Intervention (if deemed appropriate) at the earliest possible stage to confine small infestations can therefore be expected to pay very large dividends in nature conservation, and possibly also in the commercial sector.

Table 3 and **Figure 3.** Numbers of samples from which *Phytophthora* species were isolated by the VHS in 2005-2006.

***Phytophthora* species**	**No. of samples with positive *Phytophthora* recovery**	
	Primary result	**Second species[1]**
P. cinnamomi	547	
P. citricola	46	1
P. sp.2 [2]	31	
P. cryptogea	3	
P. nicotianae	0	
P. species [3]	22	1
TOTAL	**649**	**2**

[1]Second species – these samples yielded a second *Phytophthora* species, each of them in addition *to P. cinnamomi.*
[2]P. sp. 2 denotes a new *Phytophthora* species resembling *P. citricola.*
[3]*P.* species denotes *Phytophthora* cultures that are in the process of being identified or are unable to be fully identified.



4. Historical record of VHS operations and samples processed

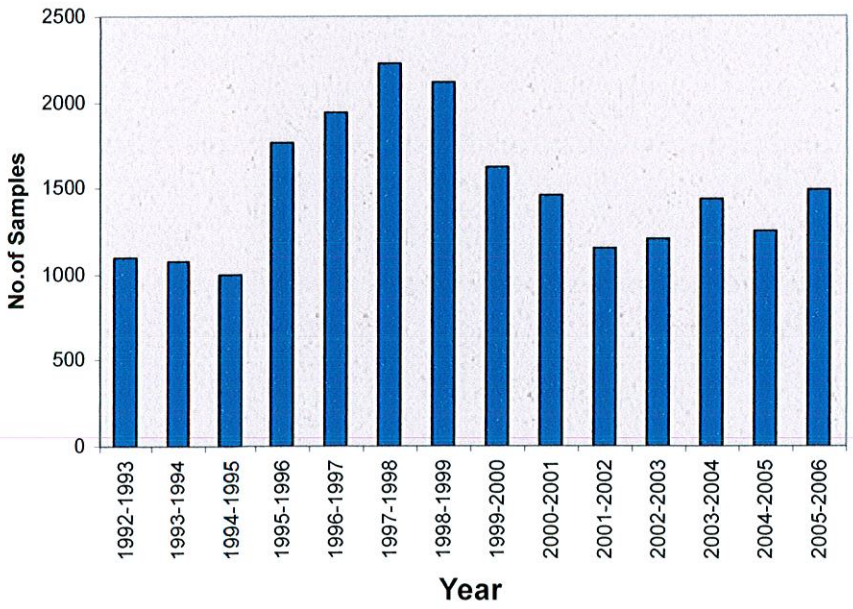
Since the Vegetation Health Service laboratory was established at Kensington Research Centre in 1992 (initially as the Dieback Detection Service), a total of 20,847 samples have been processed for *Phytophthora* (to 30th June 2006) (Table 4 and Figure 4).

Prior to 1992, the routine sample processing was carried out at Dwellingup Research Centre. All *Phytophthora* species identification from samples processed between 1985 and 1992 was completed by M Stukely at Kensington. Records from these earlier years, for which map references are available, have been included in the VHS database which now has a total of 27,529 records.

The VHS was managed between 1992 and 2001 by Francis Tay, and from 2001 by Mike Stukely. Technical support (1 FTE) is provided on a time-share basis by Janet Webster and Juanita Ciampini.

Table 4 and **Figure 4.** Numbers of samples processed by the VHS for *Phytophthora* detection from 1992-93 to 2005-06.

Year	No. of Samples
1992-1993	1095
1993-1994	1075
1994-1995	1001
1995-1996	1767
1996-1997	1944
1997-1998	2227
1998-1999	2115
1999-2000	1626
2000-2001	1463
2001-2002	1153
2002-2003	1210
2003-2004	1435
2004-2005	1250
2005-2006	1486
TOTAL	**20847**



5. Concluding Comment

Land managers are encouraged to make full use of the services provided by the VHS for the detection of *Phytophthora*. The sample-processing service is provided free of charge to all DEC and FPC personnel and sections.

The implementation of **Best Practice management methods and standards** for *Phytophthora* dieback is based upon the key steps of detection, diagnosis, demarcation and mapping of infested areas, and hence the identification of uninfested areas (CALM, 2002). The VHS laboratory testing of samples for the presence of *Phytophthora* is an integral part of this process.

It is important to recognise that areas must be **regularly re-assessed and re-tested** for *Phytophthora* infestation, since with time the pathogen will continue to spread from its known, established foci. This spread may be autonomous (by root-to-root contact between host plants, and through dispersal of zoospores in water), or through the activity of vectors such as native and feral animals, and people with their vehicles and machinery.

The **appropriate frequency of re-assessment and re-testing** will depend upon several factors:

- the **values** associated with a given area,
- the **likelihood** or **level of risk** of introduction of *Phytophthora* into that area, and
- the **consequences** of its introduction to the ecosystem.

Information on the distribution of *Phytophthora* must be up-to-date for land management to be most effective.

6. References

CALM (2002). *Phytophthora cinnamomi* and disease caused by it. Volume I – Management Guidelines.

Cunnington JH, Jones RH, de Alwis S, Minchinton EJ (2006). Two new *Phytophthora* records for Australia. *Australasian Plant Pathology* **35**, 383-384.

Graticule shown at 2 degrees intervals

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