

Dragon Search: Public Report

Summary of Victorian Sighting Data to April 2005

Prepared by J.L. Baker, for Dragon Search Community-Based Monitoring Project



The following organisations and programs have supported and/or promoted Dragon Search in Victoria:



Natural Resources and Environment



THE MARINE & COASTAL COMMUNITY NETWORK



Aquatic Naturalists

This report discusses the sightings recorded by Dragon Search divers and beachcombers in Victoria, between February 1997 and April 2005. Additional “historical” records from Dragon Search reporters in Victoria and South Australia, and from a database provided by the South Australian Museum, are presented in section 13 of the report. In many cases, specific locations at which live seadragons have been sighted are not discussed in this report, to preserve a confidentiality agreement made between Dragon Search and the divers who have provided information for the program. However, site-specific details have been listed for those localities that are well known (and publicly promoted), for viewing seadragons, and also for those localities from which dead specimens in the beachwash have been recorded.

Acknowledgements

Dragon Search thanks the organisations, government programs and companies whose logos appear above. All have supported and/or promoted the Dragon Search program in Victoria, particularly staff and volunteers from the Marine Discovery Centre at Queenscliff, who have managed the Dragon Search Program in that State.

Table of Contents

1. State-Wide Distribution of Sightings..... 3
2. Bioregional Distribution of Sightings 3
3. Sighting Details..... 6
4. Habitat Details..... 8
5. Behaviour 10
6. Seadragon Groups and Singles 11
7. Brooding Male Seadragons 13
8. Juvenile Seadragons..... 15
9. "Beachwashed" Seadragons 16
10. Other Data (Depth of Sightings; Water Temperature)..... 17
11. Seahorse and Pipefish Sightings..... 19
12. Other Notable Species 19
13. Historical Records (pre - Dragon Search)..... 20
14. References 20
Appendix 1: Summary Maps of Seadragon Sighting Data..... 21

1. State-Wide Distribution of Sightings

- **Both Species:** To April 2005, 154 sightings of seadragons have been recorded in and around Victorian waters for the Dragon Search Program, including 2 records in which leafies and weedies were recorded together. The majority of sightings were recorded between 1997 and 2003, and the few sightings recorded before this period that were made available to Dragon Search, are discussed in Section 13 below. To date, 565 seadragons have been recorded, including an unknown number of repeat sightings of the same animals.
- **Weedies:** To date, there have been 135 sightings of weedies (representing a maximum of 502 animals), including repeat sightings of the same seadragons.
- **Leafies:** To date, 19 sightings of leafies have been recorded (representing a maximum of 63 animals), including repeat sightings.

2. Bioregional Distribution of Sightings

- **Both Species:** Eighty three percent of sightings, and around 93% of the total number of seadragons sighted, have come from locations in the Victorian Embayment, a bioregion which includes Port Phillip Bay, Western Port Bay, and the waters of Corner Inlet and the Nooramunga area; almost 10% of sightings (4% of seadragons) have been recorded from the Victorian section of the Otway Bioregion (the total area of which includes the waters off the far north-western tip of Tasmania, south-western Victoria and south-eastern South Australia, Western Bass Strait and King Island (IMCRA Technical Group, 1998); and 4% of sightings (2% of seadragons) came from the Central Victorian Bioregion, which comprises an approximately 16km wide strip (from coast to sea) of waters between the Cape Otway National Park area in the west, to Warratah Bay in the east. One sighting was recorded from the Gippsland area (Cape Conran) in the Twofold Shelf Bioregion, which extends from eastern Victoria / eastern Bass Strait into southern New South Wales, and 3 sightings were recorded from the Victorian section of the Flinders Bioregion (which comprises the waters between north-eastern Tasmania and the southernmost part of Victoria, and also includes islands of the Furneaux Group, such as Flinders and Cape Barren Islands). Not surprisingly, no sightings to date have been recorded offshore in the Central Bass Strait Bioregion, which is directly seaward of the Central Victorian Bioregion, and not connected to land. The figures cited above are likely to reflect greater knowledge of the Dragon Search program amongst divers (and a relatively greater number of divers) in the more populated and accessible areas of Victoria (such as popular dive spots near settlements at the base of the Mornington and Bellarine Peninsulas), compared with the limited area available for diving in both the Flinders and Central Bass Strait Bioregions (i.e. with very little or no coastal area in the Victorian sections of those bioregions).
- **Weedies:** Of the 135 sightings of weedies, 83% of the records have come from locations in the Victorian Embayments Bioregion (VES); around 9% have come from the Otway Bioregion (OTW), around 4% from the Central Victorian Bioregion (CVA), and 2% from the Flinders Bioregion (FLI).

- **Leafies:** Around 84% the few leafy seadragon sightings recorded to date have been recorded in the Victorian Embayments Bioregion; 2 sightings have been recorded in the Otway Bioregion, and 1 from the Central Victorian Bioregion.

Note that relative abundance of seadragons at each location cannot be determined, due to the non-systematic nature of Dragon Search sightings, which are influenced by diver preference regarding choice of dive site; accessibility of dive site; possible higher promotion and recognition by divers of Dragon Search in metropolitan and other popular diving locations compared with more remote areas, and other factors.

Similarly, it is not possible to determine the proportion of sightings per location that are repeat sightings of the same animals or groups of animals. However, as indicated by the sighting numbers in the tables below, various locations near the entrance to Port Phillip Bay are places where seadragons have been regularly sighted during the past 8 years of recording. The preponderance of records from these locations is perhaps indicative of regular reporting (from repeated diving) at those sites which are easily accessible and/or contain popular features for diving, the latter particularly including various pier and reef dive sites at the bottom of the Mornington Peninsula (e.g. Portsea Pier; Flinders Pier) and Bellarine Peninsula (Queenscliff). **Maps 1a** and **1b** in **Appendix 1** summarises the statewide distribution of weedy and leafy seadragon sightings in each Bioregion, to April 2005.

Tables 1 and **2** below summarise the main areas within 4 of the main Victorian Bioregions where divers have sighted seadragons (including repeat sightings at the same location). Specific locations are not provided, to maintain a confidentiality agreement between Dragon Search and divers, hence “markers” (i.e. nearest town or other commonly recognised coastal feature) are presented. **Maps 2a, 2b** and **2c** in **Appendix 1** also summarise the bioregional distribution of seadragon sightings.

(i) **Victorian Embayments (VES) Bioregion**

Markers	Total No. of Weedy Sightings For Listed Markers
<i>Portsea</i>	50
<i>Queenscliff</i>	29
<i>Flinders</i>	16
<i>Rye</i>	5
<i>Shoreham</i> <i>Merricks</i>	4
<i>Somers</i>	3

Table 1: Broad Summary of Weedy Seadragon Sightings in the VES Bioregion

Weedies: Around 43% of the 112 VES Bioregion sightings of weedy seadragons, have been recorded in the Portsea area, almost all of which referred to the Portsea Pier, a popular site for dive training and dive charters. Another 25% of VES Bioregion sightings of weedies have come from the Queenscliff area, mostly due to diving and snorkelling at recognised reef diving spots such as the reef wall nearshore to the “Cottage by the Sea” building, and other reefs in the vicinity of the lighthouse and fort. Single sightings for which Queenscliff is a close marker, include the rock pools at one of the local beaches, and the marine reserve at Popes Eye, at the bottom of Port Phillip Bay, between the two peninsulas. South of Queenscliff, single sightings have been recorded at the boundary of the VES and CVA Bioregions (at a site north of Point Lonsdale, near “the Narrows”); Lonsdale Bight beach (beachcombing), and at a reef dive spot off Point Lonsdale. Around 14% of the Victorian Embayments records of weedies have come from Flinders Pier and surrounds (bottom of Western Port Bay), near one of the boundaries of the VES and CVA Bioregions; 3 records have come from the Somers Beach area (Western Port Bay), and there are 6 beachcombing records of weedy seadragon specimens from the Shoreham / Point Leo / Merricks Beach area, west of Somers (Western Port Bay). To date, there have been 5 records of weedies from the Rye area (mostly the Pier), and one sighting from near Blairgowrie, both towns at the base of Mornington Peninsula, and there is one record from night diving in the Portarlington area, near Geelong on the Bellarine Peninsula.

Leafies: Sixteen sightings of leafy seadragons have been recorded in the VES Bioregion (**Table 2**). Of those sightings, half have come from the Queenscliff area. Four sightings have been reported from the Flinders area, and single sightings have been recorded from sites in lower Port Phillip Bay, such as the Portsea area (Mornington Peninsula); two piers at the tip of the Bellarine Peninsula, and a site off Point Lonsdale, the latter on the Bellarine Peninsula at the entrance to Port Phillip Bay, where the VES Bioregion meets the Central Victorian (CVA) Bioregion.

Markers	Total No. of Leafy Sightings for Listed Markers
<i>Queenscliff</i>	8
<i>Flinders</i>	4

Table 2: Broad Summary of Leafy Seadragon Sightings in the VES Bioregion (excluding single location sightings)

(ii) Otway (OTW) Bioregion

Thirteen sightings of weedy seadragons were recorded from locations in the Otway Bioregion, and 7 of these were beachcombing records. **Table 3** below shows the markers for the majority of the Otway records to date. Additionally, single sightings of weedies in the beachwash have come from Nirranda Beach, and also from Ocean Beach (Nelson) near the South Australian border. Only 2 leafy seadragon sightings have been recorded to date from the OTW Bioregion, these being from reef at Portland, and a reef at Port Fairy.

Marker	Total No. of Weedy Sightings for Listed Markers
<i>Portland</i>	5
<i>Curdies River / Peterborough</i>	4
<i>Warrnambool</i>	2

Table 3: Broad Summary of Weedy Seadragon Sightings in the OTW Bioregion

(iii) Central Victoria (CVA) Bioregion

Sightings of weedies from the CVA Bioregion, are records of specimens in the beachwash, from beaches near Point Addis (3 records), Torquay and Walkerville (the latter record was of a weedy floating in the shallows), and from Moggs Creek near Airey's Inlet. Walkerville is on the eastern edge of the CVA Bioregion, near the boundary of the Central Victorian and Flinders bioregions. To date, there has been a single sighting of leafy seadragons from the CVA Bioregion - a group of 5 animals recorded at a reef off Anglesea.

(iv) Flinders (FLI) Bioregion

To date, only 3 sightings have been recorded from the Victorian section of the Flinders Bioregion, these being beachcombing records of weedies from Sandy Point, near the Shallow Inlet Marine and Coastal Park (boundary of the FLI and CVA bioregions).

3. Sighting Details

(i) **Seasonal Summary of Sightings:** Figure 1 below shows a monthly summary of seadragon sightings to April 2005. Of the sightings for which month was recorded (i.e. all except 6), around 34% of all sightings were made during the summer months (representing 34% of the total number of seadragons sighted to date); 34% of sightings (nearly 39% of seadragons) were recorded in autumn; 13% in winter (12% of seadragons sighted) and almost 19% in spring (15 % of seadragons sighted). For diving and snorkelling records only (i.e. excluding beachwash records), 31% of sightings occurred in summer, 38% in autumn, nearly 13% in winter and nearly 18% in spring.

Weedies: Around 31% of weedy seadragon sightings were made during the summer months (representing 31% of the total number of weedy seadragons sighted); 35% of sightings (42% of weedies sighted) were recorded in autumn, nearly 14% in winter (= 13% of weedies sighted) and nearly 20% in spring (= 14% of weedies sighted).

Leafies: Of the 18 leafy sightings for which month was recorded, 10 of these sightings occurred in summer, 4 in autumn, 1 in winter and 3 in spring.

Neither relative frequency nor abundance of seadragons per sighting location can be meaningfully discussed on a seasonal basis due to the non-standardised nature of the recording, which is affected by a number of factors. These include (i) uneven distribution of recordings over space and time; (ii) individual preferences in the locations and seasons in which recorders chose to dive or beach-walk (e.g. summer and autumn are more popular times for diving, because the water is warmer than in winter or spring); (iii) weather and/or sea conditions, and (iv) other opportunistic and/or uncontrollable aspects of the recordings. However, monthly distribution of seadragon sightings provides important supporting information when assessing seasonality of breeding, as discussed in the section below on **Brooding Male Seadragons**.

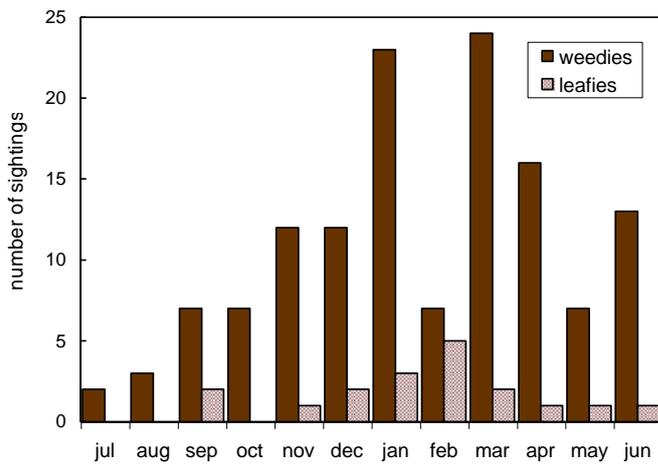


Figure 1: Monthly Summary of Seadragon Sightings, to April 2005

- (ii) **Summary of Sighting Modes:** To date, around 63% of all seadragon sightings have been recorded by SCUBA dives during the day. This represents 74% of the total number of seadragons sighted, including repeat sightings. Almost 17% of sightings were records from *beachcombers* (representing only 5% of the total number of seadragons sighted); around 16% of sightings (and 18% of seadragons) were recorded during *snorkelling*, less than 3% of sightings were recorded during *night diving*, and less than 2% by *other means*. Around 44% of the 95 day SCUBA diving records came from Portsea (mostly Portsea Pier); 21% came from Queenscliff, 18% from Flinders Pier, and 6% from dive sites off Portland. The first three are popular and accessible diving locations, particularly Portsea and Queenscliff, which are used for diver training, and dive charter / tourism trips. The remaining day diving records came from the piers at Rye (3 records), St Leonards and Portarlington; dive sites off Point Lonsdale and Blairgowrie; a reef off Anglesea; and sites off Warrnambool and

Port Fairy, in south-western Victoria. Thirteen of the 25 snorkelling records have come from reef areas off Queenscliff, with the remainder from Portsea Pier (5 records), Point Lonsdale area (3 records), Rye Pier (1 record) and Somers Beach (1 record). All snorkelling records to date have come from the Victorian Embayments Bioregion. The small number of seadragons sighted by beachcombers, relative to the number of sightings by that sight mode, reflects the fact that mainly single specimens were found in all but 3 sightings, compared with SCUBA diving, during which several large groups were recorded, which boosts the total number of seadragons sighted by that mode. Night diving records (which accounted for nearly 3% of the total number of seadragons sighted) came from Portsea (a record of 6 weedies), Queenscliff (1 juvenile leafy) and the Portarlington area (record of 6 adults and 3 juveniles under the pier). Records by *Other* sight modes included a weedy seadragon found floating on the surface of the water at a beach near Walkerville; a damaged weedy seadragon found floating near the surface of the water at Merricks Beach, and a large leafy seadragon found in a fish trap at Queenscliff. Of the 19 sightings of leafy seadragons in the database, almost all have come from SCUBA divers, and there are no records by beachcombers to date.

4. Habitat Details

To date, habitat type has been specified for almost all sightings by the applicable modes (i.e. *SCUBA*, *snorkelling*, *night diving*, *other means*), totalling 126 records, and 560 seadragons (i.e. 497 weedies and 63 leafies). There appeared to be some lack of standardisation in the recording of habitat details, and therefore categories discussed below are not mutually exclusive, and thus percentages do not sum to 100. There were many mixed habitats recorded, containing more than one of each of the main categories (e.g. *seaweed*, *reef*, *giant kelp*, *seagrass*, *sand* etc). Notable results to date include the following:

- There was a high incidence of weedy seadragons reported from habitats containing *sand* (e.g. 28% of weedy seadragon records, and 43% of weedy seadragons sighted), which including areas dominated by sand, as well as mixed habitats of sand / seagrass, sand / seaweed, sand / seaweed / reef, and several records in which mud or rubble was also recorded with sand and seagrass. The majority of records for which sand was listed also contained other cover in the vicinity of the sighting, such as seaweed and seagrass patches. This is expected, considering that (i) bare sand habitats are of less interest to divers, and thus fewer records come from such areas, irrespective of other factors; (ii) lack of food availability for seadragons is possible over large stretches of bare substrate; and (iii) seadragons may prefer vegetated habitats as a means of camouflage. For leafy seadragons, only 3 of the 19 records specified sand in the habitat details, but these three records account for 22% of the number of leafies sighted to date in this program, due to a sighting of a “mass” of 12 leafies over sand, next to a rubble reef.
- Records of both weedies and leafies from both *reef* and/or *seaweed*-dominated habitats. For weedy sightings, 23% of records listed *reef* habitat (= 14% of weedies sighted), and 24% listed *seaweed / algae* (= 24% of weedies sighted), including combinations of those two categories, and other mixed categories

containing both *seaweed* and *reef*, but excluding *kelp*, which is discussed separately below. For leafy seadragon sightings, 11 of the 19 records listed *reef* as one of the descriptors (representing half of the total number of leafies sighted), and 3 listed *seaweed / algae* (representing 14% of the number of leafies sighted to date).

- Records of seadragons (10% of sightings, and 5% of all seadragons recorded) from habitats containing *kelp*, including Giant Kelp. *Macrocystis angustifolia* is the Giant Kelp species that occurs in Victoria (see Womersley, 1987). In some cases, “kelp”, unless specified as Giant Kelp, may also refer to *Ecklonia radiata*, which is in the same marine plant order (Laminariales). Records of kelp include both kelp-dominated habitats and reefs where kelp was present with other seaweeds. Kelp was also recorded as a component of reef and sand habitats, and one record also specified seagrass as occurring in the kelp habitat. There were 3 records of leafies occurring in kelp habitat (representing 3 animals sighted).
- There was an inflated incidence of seadragon sightings over *seagrass* habitat, or mixed habitats containing seagrass (around 32% of sightings, representing 62% of all seadragons sighted). The high incidence of seagrass habitat reflects the large number of dives at several popular locations where seagrass is present – Portsea Pier (18 records, some of which also include - in addition to the seagrass - seaweed / algae, sand patches and, to a lesser extent, rubble); Flinders Pier (15 records, including other habitat details, such as sand and seaweed/algae, and 1 record of a “wreck” as part of the habitat); and several sites off Queenscliff, includes mixed reef, seagrass and sand habitat. Seagrass was also recorded at Somers Beach, and dive sites off Portarlington and Portland. At Flinders Pier, one diver (A. Raff, pers. comm. to Dragon Search, 2002), reported that seadragons were most numerous along the edges of sand and seagrass areas. There were 4 records of leafy seadragons in seagrass habitat, representing 20 of the 63 leafies sighted to date. The comparatively large number of records from specific locations favoured by Dragon Search reporters (such as Portsea and Flinders Piers, and sites off Queenscliff), can bias statewide summary results of habitat data, in terms of percentage calculations.
- The occurrence of seadragons in habitat types containing *rubble* or *pebbles*. Rubble bottom was recorded at Portsea Pier (mixed habitat, also containing sand, seagrass and patches of seaweed), Flinders Pier, and at Point Lonsdale. Seven sighting records of weedy seadragons specified rubble habitat, or mixed habitat containing rubble. One sighting of a group of 12 leafy seadragons specified the habitat as being sand adjacent to rubble reef, in the Point Lonsdale area.
- A sighting from the Portarlington area, which reportedly contained “mud-silt” bottom, with sand and seagrass (N.B. “mud” was also recorded at Portsea Pier, as part of a mixed habitat with sand, seagrass, rubble and seaweed); and
- A sighting of leafy seadragons that listed *other* habitat type as jetty rubbish at Flinders Pier.

One diver (A. Raff, pers. comm. to Dragon Search, 2002) provided details of the large amount of rubbish littering the habitat at Flinders Pier, which included plastics, bottles, steel, batteries and numerous other items; cleaned shellfish and other fished species; fishing line and associated fishing gear. The diver reported that there is a large amount of human traffic at this site, because it is popular for fishing, boating and diving.

Another diver who records seadragons at Flinders Pier reported seadragons near the pylons, and also just above the seaweed, close to the sandy bottom.

A snorkel diver provided specific details about habitat off Point Lonsdale, where that person has observed seadragons for about 10 years. The diver reported that seadragons often hover at the edge of gutters and overhangs, close to sandy bottom. The diver reported seeing the seadragons further offshore in deeper water during rough weather, when a lot of (drift) kelp and other seaweed collected further inshore in the habitat where the seadragons are usually seen.

5. Behaviour

To date, behaviour has been recorded for 356 seadragons, including repeat sightings. No behaviour was recorded for 37% of animals sighted by the applicable methods (*SCUBA, night diving, snorkelling, or other sighting means*), including sightings of seadragon aggregations. **Table 4** below summarises the main behaviours observed for individuals and groups of seadragons, as a percentage of the sum of the number of seadragons for which behaviour was recorded. Around 43% of the seadragons with recorded behaviour were hovering or resting; around 30% were recorded as both swimming and hovering; 12% of animals sighted were swimming, and about 4% were feeding. About 5% of records included 3 behaviours (feeding, hovering, swimming), in cases where more than one seadragon was observed, and each presumably displayed a different behaviour.

Main Behaviour Observed	% of Seadragons for which Behaviour was Recorded
<i>Hovering / Resting</i>	43
<i>Swimming</i>	12
<i>Hovering and Swimming</i>	30
<i>Feeding / Swimming / Hovering</i>	5
<i>Feeding</i>	4
<i>Feeding and Swimming</i>	2

Table 4: Summary of main behaviours observed

6. Seadragon Groups and Singles

Weedies: Groups of weedy seadragons have been recorded at a number of locations in the Victorian Embayments Bioregion, and several have also been recorded from sites in the Otway Bioregion. **Table 5** below summarises the sightings of weedy seadragon groups, from 3 to 40 animals. It is possible that some of these records represent repeat sightings of the same animal(s), or the same members of loosely structured seadragon groups, recorded either during the same day, or, in the case of some groups, within a few weeks of the previous dive. For example, recorded in the database are the following similar records:

- Two sightings of a single adult weedy recorded in sand habitat at Portsea Pier on the same day in April 2003, with 3 hours difference between the sightings;
- Three sightings of weedies from Portsea Pier at similar depths in June 2002 (2 animals in one of the sightings, and 1 each in the other two sightings);
- Two sightings of weedies (6 adults in one sighting and 3 adults plus 4 juveniles in the other), observed on the same day, at the same depth, in the same habitat type, recorded at Portsea in April 2002;
- Five records of 4 weedies each recorded at the same depth at Portsea Pier on the same day, in March 2002, but during different times of the day;
- Two sightings of weedies (2 adults in one sighting and 2 juveniles in the other), observed on the same day, at the same depth, in the same habitat type, at Portsea in March 2002.

The largest groups of weedy seadragons recorded in the database have all been observed at Flinders Pier. Sightings of “mass” numbers from the area include a record from 2004 of 20 adult weedies; 3 records from 2002 (of 25 weedies, 40 weedies and 20 weedies, observed in February, May and June respectively), and a record from December 2000 of a large group of 30 seadragons. It is probable that the observations from 2002 refer to members of the same large group(s), and it is interestingly to note that such large aggregations have been observed periodically over a 5 year period (2000 – 2005), which indicates that large aggregations of seadragons are site-associated with that pier. Flinders Pier has been described by one dive organisation in Victoria as the “weedy seadragon capital of Australia”. One diver (A. Raff, pers. comm. to Dragon Search, 2002) provided details of a survey at Flinders Pier, and reported that weedy seadragons were seen in all areas directly under the Pier, from a depth of 1m, out to the extent of the survey area (10m deep, either side of the pier). The survey area extended south from the end of the pier approximately 50m, and to the east, approximately 100m. Although seadragons were noted in all parts of the surveyed area, they were most numerous along the edges of the sandy areas and the seagrass. Over 40 seadragons were recorded during the survey, including an aggregation of 10 weedies in a 1.5m x 1.5m area, in 1m of water (approximately 25m from the shore).

To date, 19 records of pairs of weedy seadragons have been reported, from the Portsea area (particularly the pier); also from a popular dive spot off Queenscliff; Flinders Pier; Blairgowrie; a site near Point Lonsdale; and sites off Portland and Warrnambool.

Commented [jlb1]: Need to know whether Raff's info can be included in the public report.

To April 2005, around 6% of weedy seadragons sighted underwater were single adults, and around 2% of animals sighted were single juveniles. The largest numbers of records of single weedy seadragons have come from popular diving locations such as Portsea Pier and reefs off Queenscliff.

No. Weedy Seadragons per Group (including repeat sightings)	Marker	Bioregion
40; 30; 25; 20 (2 records)	Flinders	VES
19	Rye	VES
15	Flinders	VES
14	Queenscliff	VES
12	Portsea	VES
12	Flinders	VES
11 (2 records)	Flinders	VES
9	Flinders	VES
9	Portarlinton	VES
8	Portland	OTW
8	Flinders	VES
8	Portsea	VES
7	Portsea	VES
6 (3 records)	Portsea	VES
5	Rye	VES
5	Portsea	VES
4 (7 records)*	Portsea	VES
4 (2 records)	Queenscliff	VES
4	Flinders	VES
4	Point Lonsdale	VES
3 (5 records)	Portsea	VES
3	Flinders	VES
3	Queenscliff	VES
3	Somers	VES

Table 5: Summary of sightings of weedy seadragon groups, from 3 to 40 animals

* (Three of the seven records of 4 weedy seadragons sighted at Portsea likely refer to the same group of animals)

Leafies: The largest groups of leafies sighted to date include an aggregation of 12 animals observed off Point Lonsdale in February 1999; also groups of 11, 8 and 5 leafies observed at Flinders Pier in September 1997, January 1999 and February 2001 respectively; and an older record of a group of 5 leafies observed at a reef off Anglesea, in January 1988. These and other records are detailed in **Table 6** below.

No. Leafy Seadragons per Group (including repeat sightings)	Marker	Bioregion
12	Point Lonsdale	VES
11	Flinders	VES
8	Flinders	VES
5	Flinders	VES
5	Anglesea	CVA
3 (3 records)	Queenscliff	VES
3	St Leonards	VES

Table 6: Summary of sightings of leafy seadragon groups, from 3 to 12 animals

Single leafies have been recorded from Queenscliff (4 records, from 1997, 1998, 2004 and 2005); Flinders Pier (December 1998); Portsea (September 1997); Portarlington (date unknown, in 2002); a reef off Portland (June 1995); and a reef off Port Fairy (May 1997).

7. Brooding Male Seadragons

Figure 2 below summarises the number of sightings reported to date, of brooding male weedy seadragons, over the entire state. No sightings of brooding leafy seadragons have yet been reported to Dragon Search in Victoria.

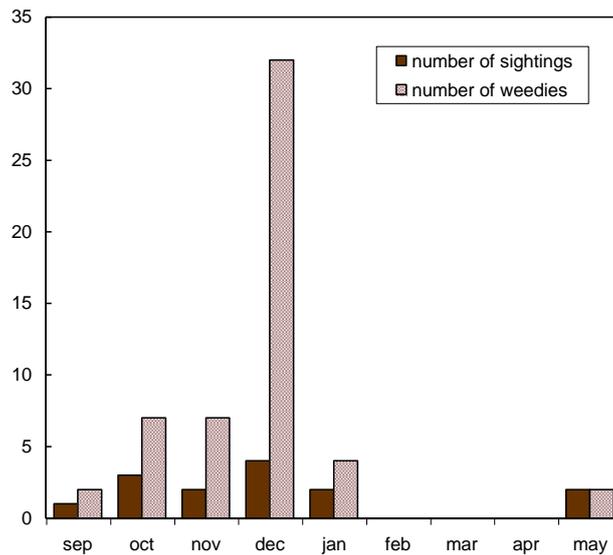


Figure 2: Monthly Summary of Brooding Male Weedy Seadragon Sightings
(N.B. Locations and Years Combined)

- (i) **Statewide Records:** To date, brooding male weedies have mainly been recorded between spring (September) and the middle of summer (January); however there are also two records (one of which has been confirmed) from Portsea Pier, of a single brood male weedy sighted in May 2002. No brooding males were observed in February, although that month is considered to be part of the breeding season in adjacent southern States (South Australia and Tasmania). At a Statewide level, with data pooled for all years, only 15 individual sightings of brooding weedy males (representing approximately 56 animals) have been recorded. The large number of brooding males observed during December, relative to other months, reflects a “mass” sighting of 25 breeding males at Flinders Pier in December 2000. Other groups of brood male weedies have been observed at Flinders Pier and at a reef off Portland (see **Groups of Brooding Males**, below). To April 2005, 11 of the 15 sightings of brood male weedies were observed between mid-spring and mid-summer (October to January). Despite the small number of brooding seadragon records available to date, and the non-systematic nature of recording across the State (amongst other factors), the data to date do support the available evidence from other southern States that spring and summer are the main periods in which weedy seadragons breed, and in Victorian waters, the egg-bearing period may also extend into autumn. At a Statewide scale, brooding male weedy seadragons have been recorded, to date, at depths ranging from 3m to 12m, and in waters ranging from 12°C to 20°C.
- (ii) **Bioregional Records:** To April 2005, 12 of the 15 records of brooding male weedy seadragons have come from sites in the Victorian Embayments (VES) Bioregion, and 3 have been recorded at sites in the Otway Bioregion. Records from the VES Bioregion include 5 from Portsea Pier, 5 from the vicinity of Flinders Pier, and 1 from a reef off Queenscliff. In the OTW Bioregion, reports of brooding males have come from sites off Portland (2 records), and Warrnambool.
- (iii) **Groups of Brooding Males:** Groups of male weedy seadragons with eggs have been observed underwater at Flinders Pier on the following dates, in descending order of number of brood males sighted: December 2000 (a record of 25 brooding males), November 2002 (6 brooding males) and December 1997 (5 brooding males). The recording of a “mass” grouping of brood males, such as that recorded at Flinders Pier in December 2000, has rarely been observed by recorders during the past 10 years of the Dragon Search Program in southern Australian States, and, if verifiable, is considered significant. Two other small groups of brood male weedies have been observed at: a reef off Portland (5 brood males recorded in October 1999), and a site off Point Lonsdale (3 brood males, recorded in January 2005). A pair of brood males was observed at Portsea Pier in 2002 (date unknown), and a pair of brood males was observed in a kelp bed off Warrnambool in September 1997. All other records have been of single brooding males.

Map 3 in Appendix 1 summarises the distribution of sightings of brood male seadragons, to April 2005.

8. Juvenile Seadragons

- Sighting Details:** To April 2005, juvenile weedies have apparently been recorded throughout most of the year, although to date, there are no records from July or January in the database. Thirty-two records of juvenile weedies have been reported, and 6 records of juvenile leafies. For weedies, the greatest number of monthly records include March (10 records), April (5 records), and October and November (3 records in each month). The largest total numbers of juvenile weedy seadragons recorded per month were in March (a total of 15 weedies) April (11 weedies), and February (9 weedies), however it is noted that such tallies are influenced by sightings of groups of juveniles. Given the season of breeding (mainly spring – summer period), it is surprising that juvenile seadragons have been observed during 10 months of the year (but see data caveats below).
- Weedies:** Table 7 below summarises the locations at which groups of juvenile weedy seadragons, with or without adults, have been observed. The largest number of juvenile weedies observed in a single sighting came from Queenscliff, where 7 juveniles and 7 adults were recorded in May 1998. Other aggregations of juveniles have come from Portsea in February 2002 (5 juveniles), April 2002 (4 juveniles, with 3 adults), and April 2005 (4 juveniles and 8 adults); Flinders Pier (a group of 4 juveniles and 7 adults recorded in February 2001); Rye Pier in March 2003 (a large group, of 4 juveniles and 15 adults), and Portarlinton in September 1997 (3 juveniles and 6 adults). Single juvenile weedies observed with several or more adults, have been reported from Flinders Pier (with 14 adults, in November, 2002); Rye Pier (with 4 adults, observed in March 2001), and Portsea Pier (4 records of single juveniles, observed with 3 adults, in October 1998, April of 2000 and 2001, and with 2 adults in August 2001). Single juvenile weedies without adults have been recorded at Flinders Pier and Rye Pier (1 record each), Portsea Pier (5 records) and another site off Portsea; Pope’s Eye (1 record), and various locations at Queenscliff (3 records).

Marker	No. Weedy Juveniles	No. Weedy Adults
<i>Queenscliff</i>	7	7
<i>Portsea</i>	5	0
	4	8
	4	3
	2	5
	2	1
	2	0
<i>Flinders</i>	4	7
<i>Rye</i>	4	15
<i>Portarlinton</i>	3	6
<i>Flinders</i>	2	1

Table 7: Summary of sightings of juvenile weedy seadragons, including juveniles with adults

- **Leafies:** To April 2005, there were 6 sightings of juvenile leafy seadragons. Two of those records were of juvenile and adult leafies observed together (i.e. 2 juveniles with 3 adults observed at Flinders Pier in February 2001, and 1 juvenile observed with 2 adults at St Leonards Pier during the same month and year). Single juvenile leafies were recorded at Portsea (September 1997), Queenscliff (December 1997), Portland (June 1995), and Port Fairy (May 1997).

There appears to be no seasonal pattern in observations of juveniles, due to the small number of records (N = 38 for the whole of Victoria, with years and locations combined), amongst other factors, including those that relate to recording. A size of less than 20cm is stated by the Dragon Search program as a guide to identifying juvenile seadragons. However, some of the records may be of small adults or young adults, and some might include misjudgments of size by recorders, which might explain the lack of seasonality of the juvenile sightings. Furthermore, more Dragon Search dives are taken in summer and autumn (when sea conditions are more pleasant) and vice versa in winter and spring, which can bias the results. For both species, it is difficult to use these data to unequivocally determine the season in which juveniles are most abundant, due to the opportunistic nature of the Dragon Search sightings, and the lack of standardisation between months regarding the distribution and frequency of recordings.

Juvenile seadragons have been observed in the major habitat types (reefs; seaweed/algae, including some reports of giant kelp; seagrass; sand; rubble; and mixtures thereof), and engaged in the commonly-observed activities (hovering / resting, swimming, and feeding).

9. "Beachwashed" Seadragons

Map 4 in Appendix 1 summarises the distribution of sightings of beachwashed seadragons, to April 2005. To date, 27 sightings of beached seadragons have been recorded, comprising a total of 31 specimens. More than half of all sightings to date were recorded between late spring (November) and the end of summer (February). Thirteen of the 26 records refer to *fresh* seadragons, and two of those records also reported *old* specimens during the same sighting. *Fresh* dead seadragons refer to recent beachwash specimens which are not shrunken or dried, are still colourful, and usually still have the appendages intact. *Old* specimens refer to dried, shrunken and/or decomposing seadragons. To date, 17 *old* beachwashed seadragons have been recorded, mostly as single specimens, although there is a record of 3 old seadragons recorded from a beach near Somers in November 1998. Only 1 live "beached" seadragon has been recorded to date (from Merricks Beach in August 2002), that being an adult weedy that appeared to have difficulty maintaining an upright position in shallow water, due to body damage.

To date, there have been few beachwash sightings per year, between 1997 and 2005 (the greatest number being 6 sightings, in 2000). There are several older, pre-1997 records (one sighting each from 1987 and 1972, both recorded at a beach west of Curdies River, in the Otway Bioregion).

To date, no “mass mortality” events have been recorded in the Victorian Dragon Search database. All but 3 of the beachwash records were of single specimens. Apart from the record of 3 seadragons on the beach at Somers, there were two records each specifying one fresh and one old seadragon, from Shoreham Foreshore Reserve in January 1999, and from Moggs Creek Beach (near Airey’s Inlet) in December 1997.

Beachwashed seadragons have been recorded from 16 locations around Victoria. Within the VES Bioregion, beachwash sightings have come from the Queenscliff area (fresh specimens, from Lonsdale ‘Bight’ beach, in January 2001, and from the beach behind the fort, in February 2000); Somers Beach (2 records from November 1998); the Shoreham area (2 sighting of weedies from the beach / foreshore reserve at Shoreham; and one sighting from between Shoreham and Flinders), and Point Leo. (2 sightings, old specimens of single weedies, recorded April and September 2002).

Within the Otway Bioregion, weedies in the beachwash have been recorded at Newfield Bay near Peterborough (1 fresh specimen from June 2000 and 1 old specimen from October 2000); a beach west of Curdies River (2 old specimens, both pre-Dragon Search sightings, from 1972 and 1987); Lady Bay at Warrnambool (a fresh specimen from November 2000); Nirranda Beach (an old specimen, from June 2000); and Ocean Beach at Nelson (a fresh specimen, from June 2000).

Five records have come from the Central Victorian Bioregion: 3 of these from Demons Bluff, west of Point Addis in December 2003 and January 2004 (all single adult weedies, fresh specimens); 1 record from Moggs Creek Beach, near Airey’s Inlet (weedies, one fresh and one old specimen, found in December 1997), and 1 record from Torquay, in May 1999 (one old specimen of a juvenile weedy, from the front beach).

Three records of beachwash specimens have come from Sandy Point in the Flinders Bioregion (each from January, in 2001, 2002 and 2004). A single beachwash sighting has been recorded in the Twofold Bioregion, from a beach east of Cape Conran (eastern Victoria), in March 2002.

10. Other Data (Depth of Sightings; Water Temperature)

- **Weedies:** To date, 103 underwater sightings of weedy seadragons have provided depth detail. The recorded depth range of weedy sightings reported by divers to date is 1m to 14m, with around 92% of sightings occurring in waters between 1m and 6m, and few sightings recorded at other depths within the range. The shallowest records of weedies to date (1m) have come from snorkelling various sites off Queenscliff, and from SCUBA diving at Flinders Pier. Records of weedy seadragon sightings by snorkellers have ranged from 1m to 10m, with most snorkelling records between 2m and 5m. About half

of the snorkelling records have come from the Queenscliff area (13 of 24 records). Records of weedy seadragon sightings from 10m and deeper have come from the Rye Pier, and a reef off Portsea (both 10m); sites off Portland and Warrnambool (both 12m); and from the Point Lonsdale area (14m). One snorkeller / diver, who has regularly observed weedy seadragons in the Point Lonsdale area for about 10 years, reported seeing seadragons over a depth range of about 2m – 20m, and that the depth changes seasonally, according to periodic movements by the seadragons into deeper water. The published depth range for weedy seadragons on the southern Australian coast, is between 1m and 50m (Kuiter, 1993, 2000; Edgar, 2000).

- **Leafies:** To date, depth has been recorded for 17 of the 19 underwater sightings of leafy seadragons, and recorded depth has ranged from 2m to 14m. Only one of those records came from snorkelling (at 2m, off Point Lonsdale). Records of leafy sightings from 10m and deeper have come from reefs off Queenscliff (10m) and off Portland (14m).

The available data cannot be used to infer the depths at which seadragons are more abundant, due to the non-systematic nature of the recordings, which are influenced by diver preferences regarding time of year, diving locations, and depth of dive. Depth recordings of seadragons in the database are also influenced by the depth of particular benthic habitat features of interest to divers (e.g. in Victoria, seadragons are often recorded near seaweed-covered reefs, reef “walls”, piers, breakwaters etc).

Similarly, little can be inferred about seasonal depth variations in seadragon distribution from available data. Several reasons include the fact that:

- (i) the number of sightings recorded per month is opportunistic, according to diver preferences;
- (ii) the survey was not standardised: i.e. seadragons were not searched for, at specific depths, in every month; and
- (iii) the uneven numbers of records between months influences the depth range of the sightings that are recorded in each month (e.g. for some months, seadragons may be found at other depths that have not been recorded, due to the smaller number of records available for those months).

Other influences include possible depth gauge inaccuracies in some divers' watches, and the fact that in some parts of the state, sighting depths are influenced by both preferred dive sites, and the depth of features at those preferred dive sites, such as depth of reef patch / “bommie”/ “pinnacle”/ rock wall etc. That is, seadragons may be found at other depths in the vicinity, but such depths were not surveyed because they did not contain the feature of dive interest.

Similar caveats apply to the interpretation of temperature recorded during seadragon sightings, particularly due to the prevalence of summer and autumn diving (i.e. pleasant diving conditions), and the under-representation of winter sightings. Of the records for which date was recorded, around 28% of the dive and snorkelling sightings in the database were recorded in summer and 40% in autumn, compared with 13% in winter. Recorded temperature for weedy seadragon sightings has ranged, to date, from 8°C to 21°C. Within

the range, around 94% of weedy seadragon sightings for which temperature was recorded, were made in waters between 12°C and 21°C, with few records at cooler temperatures, due to preference for summer and autumn diving conditions. To date, the highest reported water temperature in which weedy seadragons were sighted was 21°C, recorded at Flinders Pier in February 2002, and from sites off Queenscliff (in March 1998 and March 2001, and from an unspecified month in 2002). The lowest temperature in which weedy seadragons have been sighted to date was 8°C, recorded in shallow water (2m) at reef off Portsea in September 1997. There was also a night diving record from off Portarlington in September 1997, for which the recorded water temperature was 9°C. Water temperature was not reported in 29 of the weedy sightings from underwater. Similarly for leafies, recorded temperature for sightings to date has ranged from 21°C (Flinders Pier, January 1999) down to 8°C (Portsea, September 1997). Thirteen of the 14 records of leafy seadragon sightings for which temperature was recorded ranged between to 15°C and 21°C.

11. Seahorse and Pipefish Sightings

Seahorses were reported in 15 of the sightings, one of which referred to a beachwashed specimen. Seahorses have been recorded at the piers at Rye, St Leonards, Flinders and Portsea (also reef off Portsea), and the breakwater off Portland. The beachwash specimen, an old record from 1987, was recorded near Curdies River, Peterborough area. Pipefish have been recorded at reefs off Queenscliff and Portsea, and also at Portsea Pier.

12. Other Notable Species

Some of the other fish species observed and recorded during Dragon Search include the following:

- **Cowfish:** 5 records, including a sighting of Shaw's Cowfish (*Aracana aurita*) at a dive site in the Portland area (July, 2001); a sightings of Shaw's Cowfish from Portsea Pier in January 2005, and 3 sightings from Flinders Pier (one from May 2003, and two from December 2004), one of which specified Ornate Cowfish *Aracana ornata*;
- **Catsharks (*Parascyllium* sp.):** 4 sightings in total, from 1997, 1998 (2 sightings) and 2001, at various sites off Queenscliff;
- **Wrasse species:** To date, there are 12 records of wrasse species, mostly specifying Blue-throated Wrasse (*Notolabrus tetricus*), with 7 of the wrasse records from Portsea Pier (and 1 from Portsea Reef), 3 from Flinders Pier, and 1 from a site off Point Lonsdale.
- **Ray species:** 16 records to date, including 8 records from Portsea Pier. Two records specified the presence of Southern Fiddler Rays *Trygonorrhina fasciata* (Portsea Pier and Queenscliff). There were records of a "bull ray" (likely to refer to the Eagle Ray *Myliobatis australis*) from Portsea Pier (2 records), Rye Pier and Flinders Pier (1 record each), and from a site off Point Lonsdale (1 record). An Eagle Ray was also recorded at Queenscliff (in 1997). A record from Portsea in January 2005 of a "spotted ray" possibly refers to Smooth Stingray *Dasyatis brevicaudata*. About half of the ray records

did not specify the species; however the size of one large ray was recorded (reportedly more than 2m). Also of interest is the report from October 1998 of Shovel-nosed Rays (*Aptychotrema vincentiana*) at Portsea Pier, because southern Victoria is at the end of the geographic range of this species (see Kuiter, 1996; Edgar, 2000).

- A record of “sea snakes” at Portsea Pier likely refers to an eel species, possibly in the Congridae;
- Dolphins (*Tursiops*) were observed at Merricks Beach in August 2002.

13. Historical Records (pre - Dragon Search)

To date, the majority of records in the Victorian database were collected between 1997 and 2002. A small number of older records include the following:

- (i) 2 beachcombing records of weedies, from a beach west of Curdies River, recorded in 1972 and 1987;
- (ii) 1 record of 5 leafies from Ingoldsby Reef near Anglesea, recorded during a dive in January 1988;
- (iii) 1 record of a juvenile leafy, recorded from Bombardier Reef off Portland, in June 1995;
- (iv) 1 record of an adult weedy, recorded west of the Portsea Pier, in June 1995.

Additionally, there are two Victorian records in the South Australian database, these being:

- (v) 1 record of a fresh beachwashed weedy, collected from Barwon Heads in June, 1935;
- (vi) 1 record of an adult weedy, sighted at Portland, in September, 1935.

14. References

Edgar, G. (2000). *Australian Marine Life. The Plants and Animals of Temperate Waters*. Second edition. Reed New Holland, Australia. 544p.

IMCRA Technical Group (1998) *Interim Marine and Coastal Regionalisation for Australia: an ecosystem-based classification for marine and coastal environments*. Version 3.3. Environment Australia, Commonwealth Department of the Environment, Canberra.

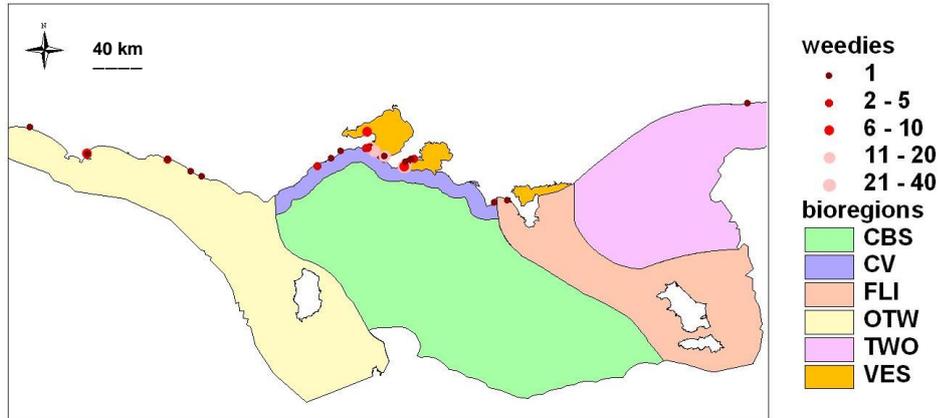
Kuiter, R. (1993) *Coastal Fishes of South-Eastern Australia*. Gary Allen Pty Ltd., Sydney, Australia.

Kuiter, R. (1996) *Guide to Sea Fishes of Australia*. New Holland Publishers Australia Pty Ltd. 430p.

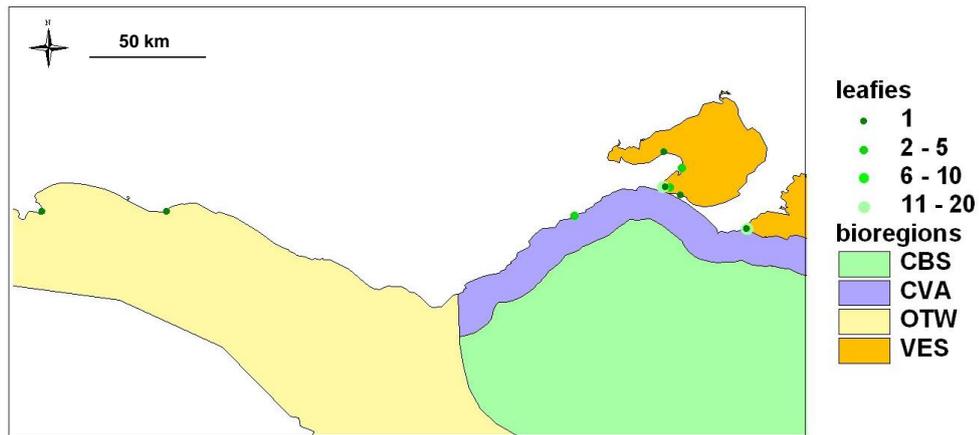
Kuiter, R. (2000) *Seahorses, Pipefishes and Their Relatives*. A Comprehensive Guide to Syngnathiformes. TMC Publishing, Chorleywood, UK. 240p.

Womersley, H.B.S. (1987). *The Marine Benthic Flora of Southern Australia, Part II*. Handbook of the Flora and Fauna of South Australia. Government Printer, Adelaide, South Australia.

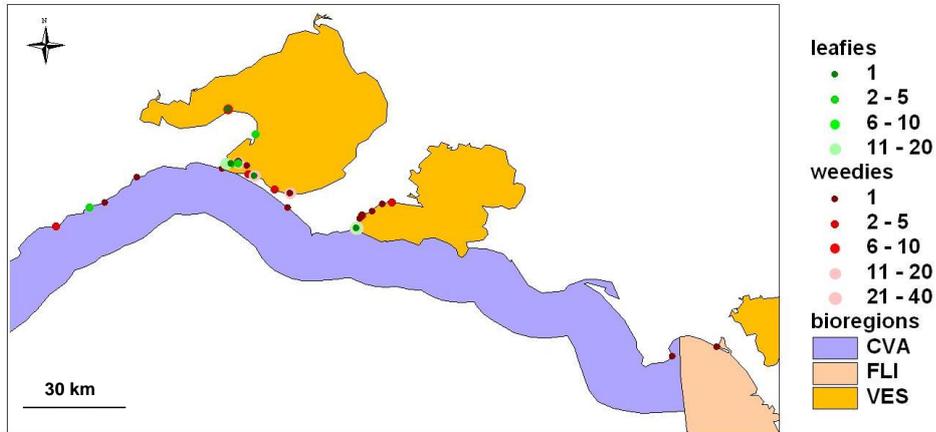
Appendix 1: Summary Maps of Seadragon Sighting Data



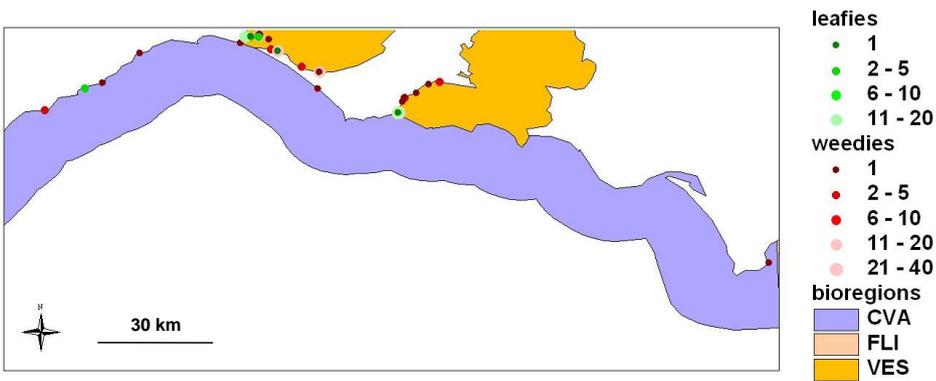
Map 1a: Statewide distribution of weedy seadragon sightings in each Bioregion, to April 2005



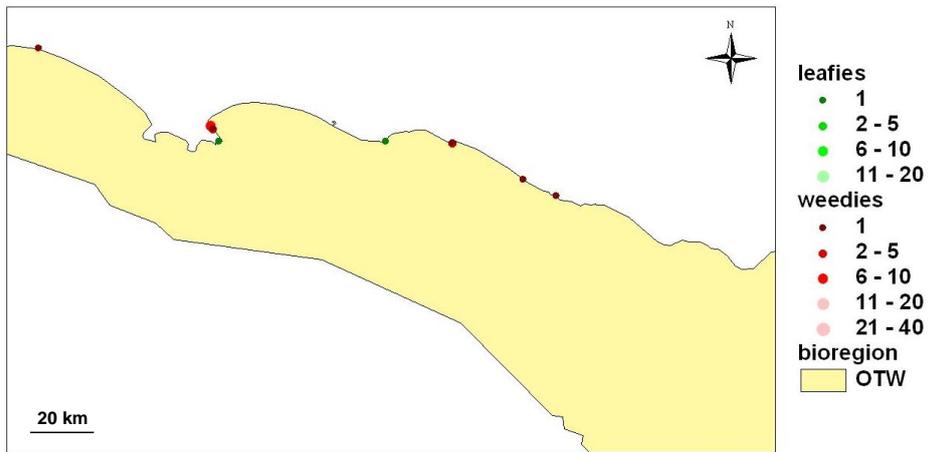
Map 1b: Statewide distribution of leafy seadragon sightings in each Bioregion, to April 2005



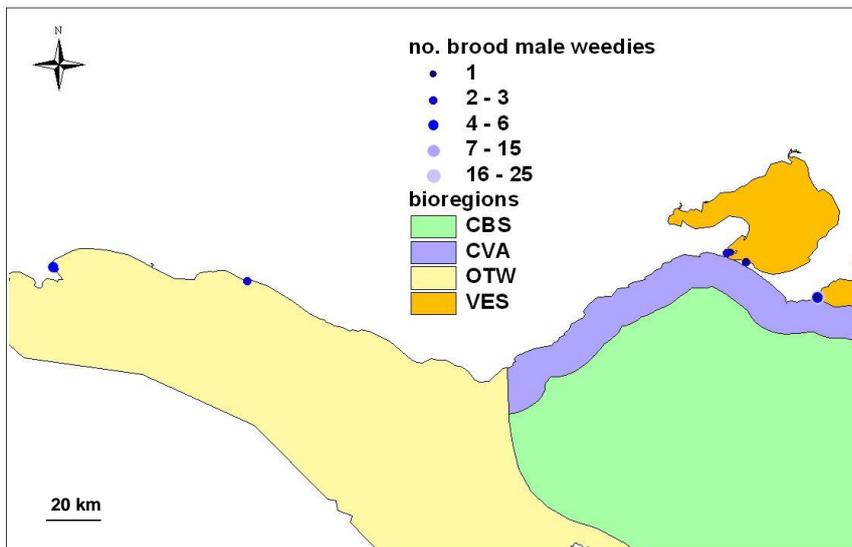
Map 2a: Seadragon sightings recorded from Victorian Embayments (VES) Bioregion, to April 2005



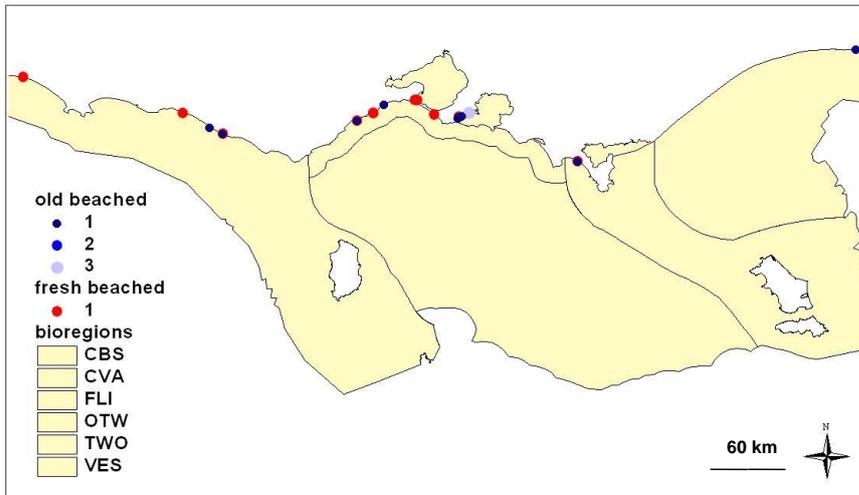
Map 2b: Seadragon sightings recorded from Central Victorian Bioregion, to April 2005



Map 2c: Seadragon sightings recorded from Otway Bioregion, to April 2005



Map 3: Distribution of brood male weedy seadragon sightings, to April 2005



Map 4: Distribution of beachwashed seadragon sightings, to April 2005