

# Dragon Search: Public Report

## Summary of Western Australian Sighting Data to September 2002

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



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### 1. State-Wide Distribution of Sightings

- **Both Species:** To August 2002, 464 sightings of seadragons have been recorded in Western Australian waters for the Dragon Search Program, including 20 records in which leafies and weedies were recorded together, and four records in which the species of seadragon was not known. To date, around 1149 seadragons have been recorded, including an unknown number of repeat sightings of the same animals. The majority of sightings were recorded between 1998 and 2002.
- **Weedies:** To date, there have been 322 sightings of weedies only (representing around 816 animals), including repeat sightings of the same seadragons.
- **Leafies:** To date, 119 sightings of leafies only have been recorded, representing 333 animals, including repeat sightings.
- **Species of Seadragon Unknown:** The four records to date represent 5 seadragons, 4 of which were dead (sighted by beachcombing).

It is noted that the database contains a number of mass sightings from trawl records, and one large aggregate record that comprises numbers from several sightings, and that such records can therefore produce bias in calculations of the number of seadragons recorded according to variables such as month, location, depth, habitat type, sighting mode etc.

## 2. Bioregional Distribution of Sightings

- **Both Species:** Forty nine percent of sightings, and around 56% of the total number of seadragons sighted, have come from locations in the WA South Coast (WSC) Bioregion, eastwards from the Walpole area on the south coast, including Albany, Bremer Bay and Esperance; 38% of sightings (and also 38% of seadragons) have been recorded from the Leeuwin – Naturaliste Bioregion (LNE) from the Perth area to the south-western end of WA, including Mandurah, Bunbury, Margaret River and Augusta; and 11% of sightings (5% of seadragons sighted) came from the Central West Coast (CWC) Bioregion, from Kalbarri south to the Perth metropolitan area. There have been 3 sightings from the Abrolhos Islands Bioregion (ABR), and 1 sighting each from the Shark Bay Bioregion, and the Eucla Bioregion (Great Australian Bight). 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 WA, including popular dive spots around the Perth metro area, North Mole (Fremantle area), Marmion Marine Park and surrounds (e.g. Hillary’s Boat Harbour), Mandurah, and south coast dive spots such as Bremer Bay, and around the Albany and Esperance area.
- **Weedies:** Of the 322 sightings of weedies only, 52% of the records have come from locations in the WA South Coast (WSC) Bioregion; around 36% have come from the Leeuwin - Naturaliste Bioregion (LNE) south of Perth, and around 11% from the Central West Coast Bioregion.
- **Leafies:** Around 47% the leafy sightings recorded to date have come from the LNE Bioregion; 37% of sightings have been recorded in the WSC Bioregion and 13% from the CWC Bioregion.
- **Weedies and Leafies Sighted Together:** Around two thirds of the sightings of both species together have come from locations in the WSC Bioregion (e.g. Bremer Bay, and sites near Esperance); 6 sightings have come from various locations south of Perth (LNE Bioregion), and 1 sighting was recorded in the CWC Bioregion (Illawong area).
- **Northern Limits of Seadragon Sightings in WA:** Kuitert (1993 and 2000) and Edgar (2000) reported that weedies are found in the southern part of WA, and a northern distribution limit of Geraldton was reported by Hutchins and Swainston (1986) and Edgar (2000). To date, the records in the WA Dragon Search database support this distribution limit, with the most northerly sighting of the 342 weedy records to date coming from the Abrolhos Islands (west of Geraldton). Hutchins and Swainston (1986) and Edgar (2000) reported that Lancelin is the northern limit of leafy seadragon distribution in WA; however the WA Dragon Search database includes reports of leafy sightings at more northerly locations than Lancelin, including Grey, Cervantes, Illawong, Port Denison, Dongara, Green Head, Geraldton, and the Abrolhos Islands. The northern distribution of leafy seadragon in WA should therefore be revised to include locations as far north as the Geraldton / Abrolhos Islands area. There is also an unconfirmed record from far northern WA, at Broome (Roebuck Bay), however this is most likely to be a record of the “Ribbioned Seadragon” (Gramp, pers. comm. 2002). The Ribbioned Seadragon (*Haliichthys taeniophorus*) is a type of tropical pipehorse for which northern WA is part of the range (Kuitert, 2000; Australian Museum 2002). Another northern WA record, from Onslow, north-east of Exmouth, may also refer to the Ribbioned Seadragon (Pipehorse), which is found in the vicinity (i.e. reported range is as far south as Shark Bay).

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 around the south coast, particularly Bremer Bay, as well as more central and easily accessible locations such as Fremantle, Rottnest Island, sites around Perth (including metropolitan beaches), and Hillary's Boat Harbour, are places where seadragons have been regularly sighted during the past several 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; contain popular features for diving (and thus dive charters also operate in some of those areas), and/or represent sites where seadragons are known to occur. **Maps 1, 2 and 3 in Appendix 1** summarise the statewide distribution of weedy and leafy seadragon sightings in 4 of the main Bioregions in which sightings occurred, to September 2002. The tables below also summarise the main locations within 3 of the main Western Australian Bioregions where divers have sighted seadragons (including repeat sightings at the same location).

(i) **WA South Coast (WSC) Bioregion**

<b>Markers</b>	<b>Total No. of Weedy Sightings for Listed Markers</b>
<i>Bremer Bay</i>	114
<i>Esperance</i>	27
<i>Albany</i>	26
<i>Hopetoun</i>	6
<i>Denmark</i>	5

<b>Markers</b>	<b>Total No. of Leafy Sightings for Listed Markers</b>
<i>Bremer Bay</i>	34
<i>Esperance</i>	9
<i>Albany</i>	7
<i>Torbay</i>	4

Around 62% of the 224 WSC Bioregion sightings of seadragons (including 63% of the weedy sightings, and around 60% of the leafy sightings in that bioregion), have been recorded from dives in the Bremer Bay area, which is a popular area for SCUBA diving and snorkeling (SCUBA Australia, 2002). Islands in the area are also popular for diving. Several of the small bays between Albany and Cape Knob and along the coast towards Esperance, are popular for snorkelling, and Cape le Grande National Park and Lucky Bay are also considered to be good dive spots, particularly for shore dives (SCUBA Australia, 2002). Albany is also a recognised diving region, and, to date, 14% of WSC Bioregion sightings (15% of weedy sightings and 12% of leafy sightings in WSC) have come from locations around Albany (including Two Peoples Bay). Albany records are mainly from SCUBA diving, but also include several snorkelling and beachcombing records. Another 14% of WSC records have come from dive spots around Esperance, such as Lucky Bay (a recognised shore diving spot) and other bays; several of the many islands that form the Recherche

Archipelago; and the Tanker Jetty (also recognised by divers for its photographic opportunities, due to abundant pylon fauna, and the presence of seadragons, in the vicinity of the tyre reef constructed at the end of the jetty). Around 3% of WSC records have come from Denmark, all of these from beachcombing, mainly at William Bay. Four records have come from Torbay, and although this is also a recognised dive site in WA, all were beachcombing records of leafies, from the Cosy Corner Beach area. Single sightings (beachwash records) have come from Walpole, Jerramungup, and Cape Riche.

(ii) *Leeuwin – Naturaliste Bioregion (LNE) Bioregion*

<b>Marker</b>	<b>Total No. of Weedy Sightings for Listed Markers</b>
<i>Fremantle</i>	27
<i>Perth Metro</i>	21
<i>Rockingham</i>	13
<i>Rottnest Island</i>	11
<i>Mandurah</i>	6
<i>Garden Island</i>	5
<i>Bunbury</i>	5
<i>Augusta</i>	5
<i>Busselton</i>	4
<i>Penguin Island</i>	3
<i>Carnac Island</i>	3
<i>Dunsborough</i>	3
<i>Margaret River</i>	3
<i>Cape Naturaliste</i>	3

Around 122 weedy sightings have been recorded from locations in the LNE Bioregion, nearly 60% of which were diving records; 21% were beach-combing records; 16% were snorkelling records; and 4 were sightings by other means. The table above shows the areas from which the majority of the LNE weedy seadragon records to date have come. Around 22% of those sightings have come from the Fremantle area south of Perth, and another 17% have come from around the Perth coastal metropolitan area. Both the Perth coastal region and Fremantle area are easily accessible for divers, and dive training courses are run at Fremantle. Around 11% and 9% of weedy sightings in the LNE Bioregion have come from Rockingham and Rottnest Island. Both regions are very popular dive locations, Rottnest in particular, having many dozens of sites around the island used for diving. Cape (Point) Peron at Rockingham is a well recognised shore diving spot, and dive trips to Garden, Carnac and Penguin Islands leave from Rockingham (SCUBA Australia 2002), and weedy sightings have come from all of those islands. Two records each have been recorded, to date, from Yallingup and Gracetown. Single sightings of weedies in the LNE Bioregion have been reported from Yanchep, Waikiki, Two Rocks, Stratham, Cockburn Sound, Cape Leeuwin, Black Rock, and Binningup.

<b>Marker</b>	<b>Total No. of Leafy Sightings for Listed Markers</b>
<i>Rottnest Island</i>	15
<i>Fremantle</i>	9
<i>Perth</i>	6
<i>Mandurah</i>	5
<i>Rockingham</i>	5
<i>Garden island</i>	4
<i>Cape Naturaliste</i>	3
<i>Bunbury</i>	3

Sixty two leafy sightings have been recorded from locations in the LNE Bioregion, nearly two thirds of which were diving records; 12 were snorkelling records; 7 were beach-combing records and 4 were sightings by other means. The table above shows from where the majority of the LNE leafy seadragon records have come. To date, approximately one quarter of those sightings to date have come from locations around Rottnest Island, which is considered to be one of the most popular diving locations in WA due to its accessibility and numerous features for divers (SCUBA Australia, 2002). Nine sightings have come from locations around Fremantle, an accessible region for divers. Single sightings of leafies have come from the Woodman Point area; Hamelin Bay and Gracetown Bay. Two records each have been reported from Burns Beach (near Mullaloo), Carnac Island, Penguin Island and Augusta.

**(iii) WA Central Coast (CWC) Bioregion**

<b>Marker</b>	<b>Total No. of Weedy Sightings for Listed Markers</b>
<i>Hillary's Boat Harbour (Perth)</i>	10
<i>Marmion (Perth)</i>	5
<i>Ocean Reef Boat Harbour (Mullaloo)</i>	4
<i>Grey / Cervantes</i>	4
<i>Scarborough (Perth)</i>	3
<i>Sorrento (Perth)</i>	3
<i>Trigg Beach</i>	3

To date, around 38 sightings of weedies have been made in the CWC Bioregion, 26% of these from the vicinity of Hillary’s Boat Harbour north of Perth. Around 53% of sightings were beachcombing records, and 42% were by SCUBA. Nine of the weedy sightings in the CWC Bioregion were from Perth beaches (Trigg, Scarborough, Sorrento). Two records have been recorded from Geraldton. Single sightings have been reported from Jurien Bay and Illawong.

<b>Marker</b>	<b>Total No. of Leafy Sightings for Listed Markers</b>
<i>Hillary’s Boat Harbour (Perth)</i>	3
<i>Marmion</i>	3
<i>Port Denison / Dongara</i>	3
<i>Jurien</i>	2
<i>Grey / Cervantes</i>	2

To date, around 16 sightings of leafies have come from the CWC Bioregion, 7 of which were reported from locations in the Perth coastal metropolitan area. Of the 16, 7 were beachcombing records and 7 were from SCUBA diving. The table above lists most of the locations at which leafies have been observed in the CWC Bioregion. Single sightings have been reported from North Beach (Perth) and the Illawong area (between Sandy Bay and Gum Tree Bay).

**(iv) Abrolhos Islands (ABR) Bioregion**

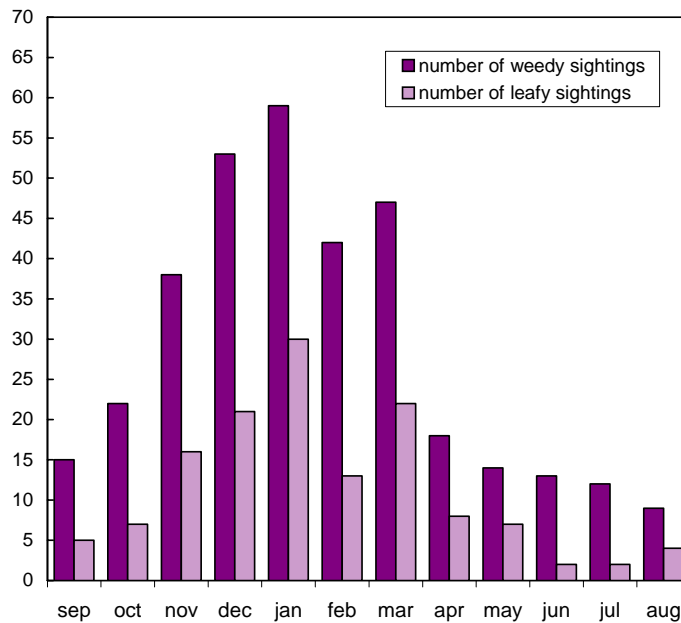
To date, only 3 sightings have been recorded from the ABR Bioregion, these being a pre-Dragon Search beachcombing record of a fresh weedy specimen reported from south-east of Pelsart Island, in July 1990; a beachcombing record of an old seadragon (species not known) reported from Hummock Island in October 1998; and a dive record of 1 adult leafy, sighted in the Abrolhos Islands, during July 2000.

**1. Sighting Details**

- (i) Seasonal Summary of Sightings:** Figure 1 below shows a monthly summary of seadragon sightings to September 2002. Of the sightings for which month was recorded (i.e. all except 2), around 46% of all sightings were made during the summer months, 23% of sightings were recorded in autumn, 9% in winter and 22% in spring. For records by diving, snorkelling and other means (i.e. excluding beachwash records), 48% of sightings occurred in summer, 24% in autumn, 7% in winter and 21% in spring.
- (ii) Weedies:** Around 45% of weedy sightings were made during the summer months, 23% of sightings were recorded in autumn, 10% in winter and 22% in spring.
- (iii) Leafies:** Similar to the seasonal proportion for weedy sightings, around 47% of leafy sightings were made during the summer months, 27% of sightings were recorded in autumn, 6% in winter and 20% 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. from late spring through to early

autumn is a popular period for diving, because the water is warmer than at other times of the year, and summer is particularly popular, accounting for nearly half of all the records by diving, snorkelling and other means ); (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 August 2002**

- (iv) **Summary of Sighting Modes:** To date, around 61% of all seadragon sightings (and 56% of the total number of seadragons sighted, including repeat sightings), have been recorded by *SCUBA* dives during the day; 25% of all records were from *Beachcombing*, which represents only 12% of the seadragons recorded; around 11% of sightings have been recorded during *Snorkelling* (= 19% of seadragons sighted, also including one aggregate record representing the total number of seadragons sighted at a particular location over a specified period), and 3% of sightings were recorded by *Other* means, representing 12% of seadragon sighted (N.B. number of seadragons sighted by other means includes mass sightings from trawl records). The small percentage of seadragons sighted by beachcombers, relative to the number of sightings by that sight mode, reflects the fact that mainly single specimens were found (although there were also several pairs and small groups recorded), compared with *SCUBA* diving, snorkelling and sightings by other means, during which several large groups were recorded, which boosts the total number of seadragons sighted by those modes. There have been no night diving records to date. Around 40% of the 284 day *SCUBA* diving records came from Bremer Bay, marketed as a popular south coast dive area where diving tours also operate; 12% came from sites around the Perth metropolitan area, both south (e.g. Cottesloe) and north (e.g. Hillary’s Boat Harbour and Marmion Marine Park, which are popular diving locations); around 10% from the Fremantle area (an accessible area for diving); 6% from Rottnest Island (one of WA’s most popular diving destinations); 6% from Esperance (e.g. Lucky Bay, Duke of Orleans Bay, and the Tanker Jetty); and 3% each from the Rockingham and Mandurah regions. Of the snorkelling records, 18% came from sites in and around Bremer Bay; most other snorkelling records

came from (collectively) Cottesloe, Fremantle, Rottnest Island; Garden Island; Albany and Cape Naturaliste, and there were two snorkelling records from northern WA locations: Mackerel Island (near Onslow, and the record likely refers to the pipehorse species known as the Ribboned Seadragon), and Dirk Hartog Island (near Denham). Around 69% of the 29 snorkelling records during which weedies have been sighted, have come from sites in the LNE Bioregion, such as Cottesloe (5 records), Fremantle (3 records), Cape Peron and Yallingup. An unusual record came from the bend in the Swan River, where a weedy was sighted at 11m depth, reportedly by a snorkeller. Records by *Other* sight modes include three records from fishers working off Albany. These three records comprised a record of a mass of around 100 adult leafies spotted by a fisher at night, off Michelmas Reef; a record of 20 adult weedies and 36 Western Australian seahorses, caught by a purse seine fisher working southwest of Breaksea Island, and released alive; and a record of 1 leafy caught during purse seine fishing for pilchards, reported to be the first capture of a seadragon by that fisher during 20 years of pilchard fishing. Other records sighted by *Other* means included:

- a weedy juvenile caught in a lobster pot near Vilarey Rock (Cervantes);
- 2 records from Fremantle (2 weedies caught in a net, 2 leafies sighted by unspecified means, and a number of seahorses also reported during both sightings);
- 1 record of 4 leafies and 4 weedies caught during purse seine fishing (at 12m depth) 700m off City Beach (Perth);
- 1 record of a weedy adult, leafy adult and leafy juvenile caught whilst prawn trawling between Garden Island and Four Fathom Bank;
- 1 record of a dead adult weedy caught in a granite crevice at Lucky Bay (Cape le Grande National Park);
- 4 near-shore sightings of live seadragons in very shallow water (i.e. 1 leafy sighted 1m from the lobster boat wharf, in 1m of water, at Port Denison Marina; 1 inactive juvenile leafy sighted in a rock pool at Penguin Island; 1 live juvenile leafy sighted amongst seaweed at Dunsborough foreshore; and 1 live adult leafy sighted close to the mouth of the Blackwood River at Augusta, in very shallow water).
- 2 other records, which referred to single weedy sightings, in which the methods of sighting were not specified.

## 2. Habitat Details

To date, habitat type has been specified for around 95% of sightings by the applicable modes (*diving, snorkelling, other means*), totalling 326 records of weedies and/or leafies, and 874 seadragons (i.e. 675 weedies and 199 leafies), including repeat sightings in the same habitats, and also including aggregate records and mass sightings specified above. An additional 10 records (representing 18 seadragons) specified bottom type (=sand) but not habitat. In the WA database, bottom type and habitat type are two separate fields with overlapping categories, resulting in a number of different combinations of bottom type and habitat recorded. There appeared to be some lack of standardisation in the recording of bottom type and habitat details, and there were also a number of *mixed* and *other* habitat types recorded. Percentages in the discussion below do not sum to 100 due to the overlap between habitat and bottom types, and the number of different combinations of habitat type recorded. Notable results to date include:

- The high incidence of weedy seadragons reported from habitats containing *sand*. Around 42% of the sightings by the applicable modes reported sand as the bottom type, (representing 40% of weedy records, and 40% of leafy records), which included sand bottom areas dominated by seagrass, as well as mixed habitats of sand/seaweed;



sand/seaweed/reef; sand/kelp; and granite or limestone patch reefs in sand. There were also several records listing sand/ rubble, and sand/kelp/rubble. The majority of records for which sand was listed also contained other cover in the vicinity, such as seagrass, seaweed or reef 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;

- Related to the above (sand bottom habitat), the high incidence of records from *seagrass*-dominated habitats, or mixed habitats containing seagrass (46% of all sightings). Almost 43% of records for which seagrass was specified as a major cover came from the Bremer Bay area. Kelp, other seaweed, patch reefs, and other features were also present in various parts of these diving and snorkelling locations for which seagrass was specified. Almost 7% of records with seagrass as a main cover, came from the Esperance area (e.g. Tanker Jetty; Lucky Bay; Duke of Orleans Bay), and 7% also came from around Fremantle (e.g. North Mole; South Mole). Examples of other seagrass-99 *kelp*, which is discussed separately below. For leafy sightings, 31% listed *reef* as one of the descriptors of bottom type or habitat type, and around 38% listed *seaweed / algae* as a descriptor under habitat type or other habitat information. Leafies and weedies have been sighted in seaweed-dominated habitats at locations around Bremer Bay, Albany, Esperance, Cape Naturaliste, Dunsborough, Rockingham, Fremantle, Rottnest Island, Garden Island, Perth (e.g. Cottesloe and Marmion), Mullaloo and other areas.
- Both weedy and leafy seadragon sightings (12% of weedy sightings and 12% of leafy sightings) from habitats containing *kelp*. Around half of all of these sightings were from kelp-dominated habitat, and the other 6 % came from mixed habitats, such as those containing kelp patches on reef adjacent to seagrass beds, or limestone reef with mixed seaweed including kelp. In Western Australia, kelp would refer to *Ecklonia radiata*, because giant kelp does not occur in that State (Womersley 1987). Sites at which kelp was the dominant cover included several sites around Bremer Bay; reefs near Hopetoun; south side of Rottnest Island; a site south-west of Garden Island; a site near North Mole at Fremantle, and reefs near Hillary’s Boat Harbour.
- The occurrence of seadragons in habitat types containing *rubble*. To date, there have been 15 records that specified rubble as either the main bottom type or as part of a habitat of mixed features or *other* habitat type (e.g. “sand, kelp, rubble”; “seagrass, seaweed, rubble”). Rubble bottom was recorded at a site in Bremer Bay; a site at Albany; Lucky Bay at Esperance; Cape Naturaliste; sites off Rockingham and Bunbury; North Mole at Fremantle; sites off Garden and Carnac Islands; Cottesloe; the Swan River, and Hamelin Bay;
- *Other habitat* was specified for around 6% of sightings. Examples of such habitats included the rock groyne at North Mole (Fremantle); the jetty struts at Rous Head Harbour (Fremantle) and the Ammunition Jetty (Woodman Point); rubble habitat and mixed rubble/kelp/sand habitat at Fremantle (see above); the seaweed-covered limestone reef patch between two breakwaters near the Maritime Museum at Fremantle; a “small cave” site at Esperance; a rock crevice and sand habitat at Marmion Marine Park; granite reef habitats (3 records from Bremer Bay); a “sponge wall” at Bremer Bay; sites dominated by “corals” (Bremer Bay, and Cape le Grande National Park); and several other mixed habitats types, which specified sand gullies, limestone patches, and “rocky reef” as part of habitats containing seaweed or kelp.
- One record from a mud bottom habitat (Palm Beach, Rockingham), which also contained some seagrass and sand in the shallows.

### 3. Behaviour

To date, behaviour has been recorded for around 745 seadragons, including repeat sightings, and mass sightings. No behaviour was recorded for 26% of animals sighted by the applicable methods (*diving, snorkelling, or other* sighting modes), including sightings of seadragon aggregations. The table 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 58% of the seadragons with recorded behaviour were hovering or resting. There was a comparatively high incidence of feeding observed (13% of the number of seadragons sighted), and a low incidence of swimming recorded (nearly 4% of seadragons sighted). Many of the records for which feeding was listed as the major behaviour also reported drifting as an associated behaviour during feeding. Feeding was observed in both seaweed-dominated habitats (such as macroalgal-covered limestone reefs) and seagrass habitats (e.g. *Posidonia* beds, and mixed *Posidonia / Amphibolis* beds). There were also several records of feeding observed in mixed reef and seagrass habitats, and at a jetty pylon habitat. Two brood male weedy seadragons were reported to be “nursing” (one of which had half of the attached eggs hatched), and there was one record of 2 weedies observed courting. The purported incidence of “defending” (18.5% of seadragons sighted, equivalent to 91 records) is not recorded in the table below, because it is possible that the code for this behaviour (“D”) was misinterpreted as “drifting” in the majority of cases; drifting was recorded in the behaviour details section for many of those records for which “D” was the behaviour code. However, 9 of the records of “defending” behaviour referred to brood male seadragons with eggs, and it is therefore possible that defensive behaviour by the seadragons was observed in such cases. There were 8 records of *other* behaviour, mostly unspecified, but also including an adult weedy “swimming fast along sandy bottom, and then up over reef” at Carlo’s Reef in Marmion Marine Park; 2 adult weedies sheltering undercover from the swell at Back Beach in Bremer Bay; 3 weedies and 1 leafy hiding behind seaweed, in a cave at a site off Cape le Grande National Park; and a record from Lucky Bay in which 5 weedies were sighted drifting in the vicinity of 1 leafy, which was stationary on the bottom.

<b>Main Behaviour Observed</b>	<b>% of Seadragons for which Behaviour was Recorded</b>
<i>Hovering/Resting</i>	58
<i>Defending</i>	(see note in paragraph above)
<i>Feeding</i>	13
<i>Other</i>	6
<i>Swimming</i>	3.75

### 4. Seadragon Groups and Singles

Groups of weedies have been recorded at a number of locations in the WA South Coast and Leeuwin-Naturaliste Bioregions. The table below summarises the locations of records of weedy group sightings, from 3 to 20 animals. It is possible that some of these records represent repeat sightings of the 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 days of the previous dive. For example, recorded in the database are the following, amongst several other pairs or sets of records that appear similar:

- Two records of 6 weedies each recorded at the same depth at Bremer Bay in January 2001, with one of the sightings reported 4 days after the other;

- Two records of 5 weedies each recorded at Bremer Bay in December 2000, with one of the sightings reported 2 days after the other;
- One record of 8 weedy adults at 6m, and one record of 5 weedy adults at 8m, recorded at a site in Bremer Bay in March 2002;
- One record of 8 weedy adults at 12m, and one record of 6 weedy adults at 7m, recorded off a beach site near Albany on the 24<sup>th</sup> and 26<sup>th</sup> December 2000 respectively;
- Three records of 5 weedy adults, recorded at similar depths (9m, 8m) on the same day (1<sup>st</sup> March 1999) at a site in Bremer Bay.

The largest groups of weedy seadragons recorded in the database have been an aggregation of 20 weedies caught in a beach seine net south-west of Breaksea Island off Albany; a group of 12 adult weedies sighted at 10m depth at a site in Bremer Bay; a group of 10 weedies sighted at 6m depth at Frenchman Bay (near Albany), and a group of 10 weedies sighted at 7m off a beach in Bremer Bay. These and other records of weedy groups are detailed in the table below.

<b>No. Weedy Seadragons per Group (including repeat sightings)</b>	<b>Marker</b>	<b>Bioregion</b>
<b>20</b>	Albany	WSC
<b>12</b>	Bremer Bay	WSC
<b>10</b>	Albany	WSC
<b>10</b>	Bremer Bay	WSC
<b>8 (3 records)</b>	Bremer Bay	WSC
<b>8</b>	Albany	WSC
<b>7 (4 records)</b>	Bremer Bay	WSC
<b>6 (5 records)</b>	Bremer Bay	WSC
<b>6</b>	Albany	WSC
<b>5 (12 records)</b>	Bremer Bay	WSC
<b>5</b>	Esperance	WSC
<b>5</b>	Rockingham	LNE
<b>5</b>	Fremantle	LNE
<b>5</b>	Rottneest Island	LNE
<b>4 (10 records)</b>	Bremer Bay	WSC
<b>3 (13 records)</b>	Bremer Bay	WSC
<b>3 (2 records)</b>	Lucky Bay	WSC
<b>3</b>	Duke of Orleans Bay	WSC
<b>3</b>	Two Peoples Bay	WSC
<b>3</b>	Albany	WSC
<b>3 (6 records)</b>	Fremantle	LNE
<b>3</b>	Garden Island	LNE
<b>3</b>	Cottesloe	LNE

There are also two aggregate records of weedies in the WA database. One of these records reported a total of 100 adult and 25 juvenile weedies, recorded during several snorkelling trips off South Cottesloe, in 1993. The recorder was a paid aquarium collector, and reported that often up to 20 seadragons of various sizes were seen in a one to two hour period,

while the collector was swimming 50m offshore (see also **Brooding Male Seadragons** section). The other aggregate record refers to a total of 10 adult weedies and 1 juvenile observed at around 4m depth, between 30/04/99 and 05/05/99, whilst the recorder was snorkelling at Flinders Bay (near Cape Leeuwin).

To date, 47 records of pairs of weedy seadragons have been reported, from Bremer Bay (24 records); Albany (2 records); Esperance area (3 records); Bunbury; Margaret River; Fremantle (3 records); Garden Island (2 records); Rockingham area (2 records); two beaches near Perth; Cottesloe (3 records); Hillary's Boat Harbour (2 records); Ocean Reef Marina; and Mindarie.

To date, nearly 24% of weedy seadragons sighted underwater were single adults, and around 3% of animals sighted were single juveniles. The largest numbers of records (18%) of single adult weedies have come from popular diving sites such as locations in Bremer Bay, (also the area from which the largest number of sightings of single juveniles have been recorded); and also popular diving and snorkelling locations around Albany (9 records, or 7% of adult single weedy records); Esperance (9 records, 5 of which were from Lucky Bay); Busselton Jetty; Augusta; Cape Naturaliste; Dunsborough; Hopetoun; Carnac Island; Garden Island; Penguin Island; Fremantle (13 records, or 11%, of adult single weedy records, and 4 records of juvenile singles); Mandurah (4 records); Perth (e.g. Cottesloe; Marmion, and various city beaches); Rottnest Island (8 records = 6.5% of adult single weedy sightings); Mullaloo and Yallingup. Single sightings of single adult weedies have come from Black Rock; Cockburn Sound; Gracetown; Two Rocks and Yanchep.

The largest groups of leafies recorded to date in the database include:

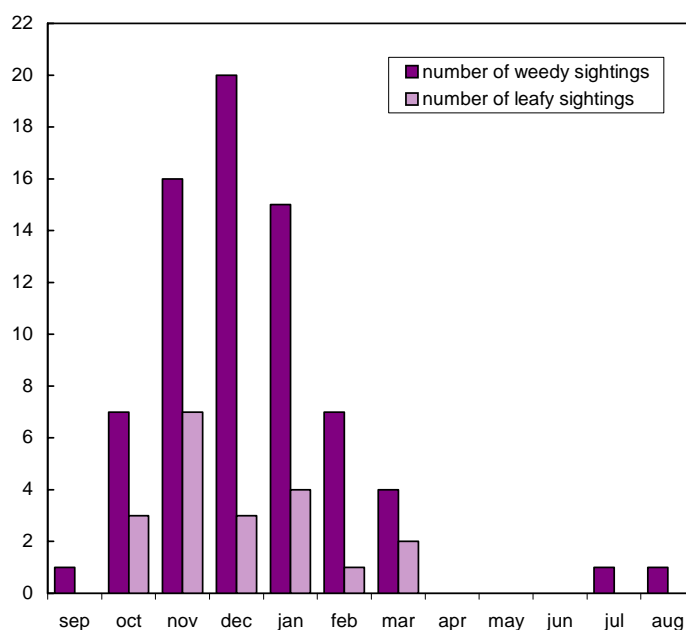
- an aggregation of approximately 100 leafies sighted by a night fisher at Michelmas Reef off Albany, in August 1998;
- a pre-Dragon Search record from April 1988 of an aggregation of 50 juveniles observed near a jetty at Fremantle (reportedly all clustered over 40 square metres, in a sand, limestone and seaweed habitat between two breakwaters);
- a group of 4 adults and 4 juveniles observed at Mullaloo in January 1999;
- 3 adults and 3 juveniles observed at Two Peoples Bay (Albany region) in January 1999; and
- a group of 6 adult leafies observed off Garden Island in September 1998. These and other records are detailed below.

<b>No. Leafy Seadragons per Group (including repeat sightings)</b>	<b>Marker</b>	<b>Bioregion</b>
<b>100</b>	Albany	WSC
<b>50 (juveniles)</b>	Fremantle	LNE
<b>8</b>	Burns Beach	LNE
<b>6</b>	Garden Island	LNE
<b>6</b>	Two Peoples Bay	WSC
<b>4</b>	Albany	WSC
<b>3</b>	Bremer Bay	WSC

Pairs of leafies have been observed at Bremer Bay (7 records); Albany; Lucky Bay near Esperance; Mandurah; Fremantle (2 records); Rottnest Island (2 records); and Cottesloe. Excluding beachcombing reports, there were 72

records of single adult leafy seadragons sighted in water, 28% of which came from sites around Bremer Bay, a popular diving location; 12.5% from bays and reefs around Rottnest Island; 7% from sites around Esperance; and 5.5% each from sites around Mandurah, Rockingham, and Fremantle. Records of single adult leafies also came from Albany; Cape Naturaliste; Bunbury; the Perth area (Marmion, Floreat, Hillary's); Garden and Carnac Islands, and Port Denison. Single sightings of single adult leafies were reported from Augusta, Penguin Island, Woodman Point, Hamelin Bay, Burns Beach, Geraldton, and the Abrolhos Islands. Single juvenile leafies were recorded in 12 different areas, including 3 records each from sites around Bremer Bay and Rottnest Island, and 3 sightings from metropolitan beaches near Perth.

## 5. Brooding Male Seadragons



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

**Figure 2** above summarises the number of sightings reported to date, of brooding male weedies, over the entire state.

- (i) **Statewide Records of Brooding Weedies:** To date, brooding male weedies have mainly been recorded between mid-spring (October) and the beginning of autumn (March); however there are single records from July, August and September. To date, around 70% of the records of brooding male weedies were reported in late spring to mid summer (November to January). At a statewide level, with data pooled for all years, 71 individual sightings of brooding weedy males (representing 109 animals) have been recorded. Around 69% of the sightings of brooding male weedies to date have been single animals, and 18% of sightings have been pairs. Despite the small number of available records per year of brooding seadragons; the non-systematic nature of recording across the State; and the preponderance of diving in summer when conditions are more conducive (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 Western

Australia, as in Victoria waters, the egg-bearing period may also extend into autumn. The spring-summer breeding period is supported by the fact that 24% of all diving and snorkelling records occurred in autumn, yet few brood males were recorded during this period. It would be imprudent to interpret the small number of records from winter and early spring months: more evidence is required before it could be confidently concluded that the egg-bearing period commences in winter in WA. At a statewide scale, brooding male weedies have been recorded, to date, at depths ranging from 2m to 28m, and in waters ranging from 16°C to 23°C, and brooding male leafies have been reported at depths ranging from 3m to 19m, and in waters ranging from 16°C to 25°C.

- (ii) **Statewide Records of Brooding Leafies:** There have been few records (N = 20) of brood male leafies to date. At a statewide level, with data pooled for all years, 21 leafy males have been recorded in the 20 sightings. As with weedies, the greatest number of brood male sightings (18 of the 20) was recorded from mid-spring to the summer months. There have been two records of brood male leafies observed in March, but no other autumn records, and there have been no winter recordings to date.
  
- (iii) **Bioregional Records:** To date, around 84% of the records of brooding male weedy seadragons have come from sites in the WA South Coast (WSC) Bioregion, chiefly from Bremer Bay (= 66% of all records of brooding weedies to date, and 78% of the WSC records); 15% of WSC Bioregion records of brooding weedies have come from sites around Albany, and 4 records have come from the Esperance area (Lucky Bay and Duke of Orleans Bay). Around 70% the records of brood male weedies from the WSC Bioregion were reported between November and January. Within the LNE Bioregion, 4 records have come from Fremantle; 3 records from the Perth area (City Beach and Cottesloe), and single sightings have come from Rottnest Island, Garden Island and Dunsborough. There has been one record of a brooding male weedy from the CWC bioregion (Hillary's Boat Harbour). Similar to the reports of brood weedies, most records (i.e. 16 of the 20 sightings) of brooding male leafy seadragons have come from the WSC bioregion, mainly from sites around Bremer Bay. Within that bioregion, there have also been two sightings of brood male leafies from the Albany area, and one from Torbay. Brooding male leafies were reported from October to March in the WSC Bioregion, with the two records from March coming from Bremer Bay. Within the Leeuwin – Naturaliste Bioregion, brooding leafies have been reported from Fremantle (2 records), Mandurah and Bunbury, the four records collectively encompassing the period October to January.
  
- (iv) **Groups of Brooding Males:** A group of 6 male weedy seadragons with eggs was observed underwater at Bremer Bay in November 1999; a group of 5 brooding male weedies was observed at Lucky Bay (Esperance) in December 1999; 4 brooding weedies were caught in a purse seine net off City Beach in January 1989 (pre-*Dragon Search*), and another record of 4 brooding males came from Bremer Bay in November 2001. To date there are five records of 3 brood males, one of these from Two Peoples Bay (November 1998), and the rest from Bremer Bay (November 1999, February 2000, December 2000 and October 2001). Twelve records of pairs of brooding male weedies have come from sites around Bremer Bay, and one pair was reported from a site off Albany (December 2000). Additionally, there is an aggregate record referring to several snorkelling trips off the South Cottesloe, in 1993. Although the total number of brood males was not specified, the recorder reported that often up to 20 weedy seadragons of various sizes were seen in a one to two hour period, while the collector was swimming 50m offshore, and that the seadragons were frequently either gravid

females, or were males with eggs attached to tail. The recorded also stated that during the early summer months, males were often observed carrying eggs (see also **Seadragon Groups and Singles** section). No groups of leafies have been reported to date in the Dragon Search WA database. Except for the record of a pair of brood male leafies observed at Mandurah in November 1998, all other records of brood leafies have been of single animals.

**Maps 4A and 4B in Appendix 1** summarise the distribution of sightings of brood male seadragons, to September 2002.

## 6. Juvenile Seadragons

To September 2002, juvenile weedies have apparently been recorded throughout the year, and juvenile leafies have been recorded in all seasons except the spring months. Fifty two records of juvenile weedies have been reported, and 21 records of juvenile leafies. Almost 36% of juvenile weedy sightings and 52% of juvenile leafy sightings were recorded during the summer months (December to February). The tables below lists the areas at which groups of juvenile seadragons, and groups of adult and juvenile seadragons, have been observed by SCUBA diving, snorkelling or other means (i.e. beachwash records excluded).

<b>Marker</b>	<b>No. Weedy Juveniles</b>	<b>No. Weedy Adults</b>
<i>Bremer Bay</i>	4 (4 records)	0; 0; 3; 4
<i>Bremer Bay</i>	3 (3 records)	0; 4; 0
<i>Rottmest Island</i>	3	2
<i>Bremer Bay</i>	2 (5 records)	0; 4; 0; 1; 3
<i>Hillary's Boat Harbour</i>	2	0
<i>Cape Peron</i>	2	0
<i>Fremantle</i>	2	1

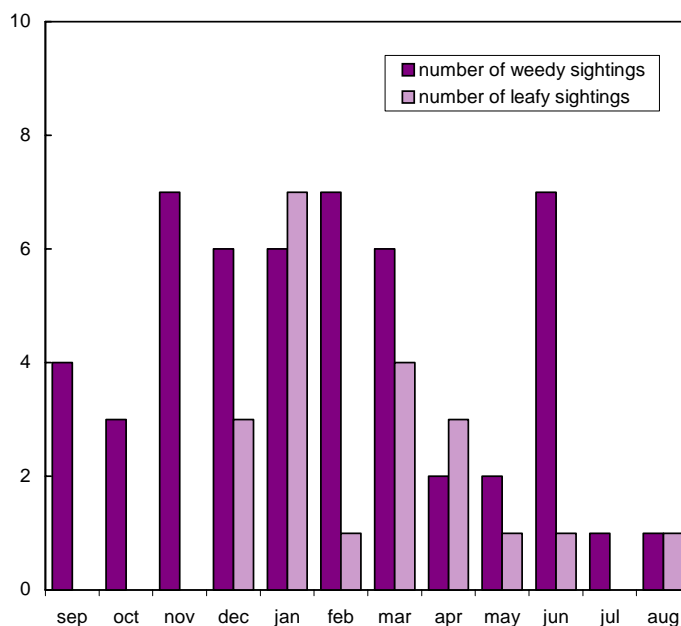
As shown in the table above, small groups of juveniles were recorded mostly at Bremer Bay. The only record to date in the WA database that refers to large numbers of juveniles is an aggregate record listing an approximate total number (= 25) of juvenile weedies observed during several snorkelling trips, off Cottesloe Beach in 1993. Excluding beachcombing records, single juvenile leafies observed alone or with one or more several adults, have been recorded at Bremer Bay (13 records); Albany (2 records); Ringbolt (near Augusta); Cape Leeuwin; Fremantle (4 records); Garden Island; Scarborough and Cottesloe Beaches near Perth; Mullaloo area, and Cervantes. Juvenile weedy seadragons in the beachwash have been recorded at Bremer Bay (2 records); Ledge Beach (Albany area); Duke of Orleans Bay and Ten Mile Beach (both near Esperance); William Bay near Denmark (2 records); Bunbury, and Stratham.

Juvenile weedies have been observed in the major habitat types (seagrass; seaweed/algae; kelp; reefs; sand and mixtures thereof), and engaged in the commonly-observed activities (mostly hovering / resting or drifting, although there were several records for which swimming or feeding were specified).

Marker	No. Leafy Juveniles	No. Leafy Adults
<i>Fremantle</i>	50	0
<i>Mullaloo</i>	4	4
<i>Two Peoples Bay</i>	3	3
<i>Bremer Bay</i>	2	0

As mentioned in the section on **Leafy Groups and Singles**, the largest number of juvenile leafies observed in one location has come from Fremantle, where a large group of juvenile leafies was observed clustered over a 40 square metre area. The table above shows other locations where small groups of leafy juveniles have been observed. Single juvenile leafies observed alone or with one or more several adults, have been reported from dive and snorkel sites around Bremer Bay (4 records); Esperance; Dunsborough; Rottnest Island (3 records); Fremantle; Gracetown Bay; Penguin and Garden Islands; Marmion, North Beach and Cottesloe Beach near Perth; and Hillary’s Boat Harbour. Juvenile leafies at the above locations were mostly hovering or drifting, although there have been two records of feeding, at Bremer Bay and North Beach, Perth. There is a record from December 1999 of a juvenile leafy drifting at a site in Lucky Bay (near Esperance), in the vicinity of 5 brood weedy males (stationary on the sea bottom, at 10m). No juvenile leafies have been observed as beachwash to date.

To date, there has been no clear seasonal pattern in the recording of juvenile weedy seadragons. Given the apparent main season of breeding for weedies (spring – summer period), it is surprising that juvenile weedies have been observed during 12 months of the year, including 7 records from June and 4 from early spring. 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 lack of seasonality of the juvenile weedy sightings. Due to these factors, as well as the opportunistic nature of Dragon Search sightings, and the lack of standardisation between months regarding the distribution and frequency of recordings, available data (to date) cannot be used to confidently state the season in which juveniles are most prevalent in WA.



**Figure 3: Monthly Summary of Juvenile Weedy and Leafy Seadragon Sightings**  
(N.B. Locations and Years Combined)



For leafies, although the number of juvenile leafy sightings is small (21), the distribution of months accords with the probable season of breeding (spring – summer), with the majority of juvenile leafies observed from summer to autumn (see **Figure 3** above). Further, there were only 2 records of supposed juveniles reported throughout winter to the end of spring, despite regular sightings of adult leafies during those months (i.e. to date, 36 records of adult leafies have been reported during winter and spring).

## 7. "Beachwash" Seadragons

**Maps 5A, 5B, 5C and 5D in Appendix 1** summarise the distribution of beachwashed seadragon sightings, to September 2002. To date, 117 sightings of beached seadragons have been recorded, comprising a total of 142 specimens. Around 38% of all sightings to date were recorded during the summer months; 25% during spring; 23% during autumn, and the remainder during the winter months. Around 58% of the sightings to date have been of *fresh* seadragons and 40% refer to *old* specimens. *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. Most records are of single specimens, although there are several records of pairs and small groups of dragons being sighted on beaches, particularly after high tides, storms and large swells. Examples include a group of 4 fresh seadragons found on Short Beach at Bremer Bay after high tides in December 1999; two sightings (6 and 5 seadragons respectively) on Back Beach (Bremer Bay), one following high tides, and the other after a storm in December 2000; and three sightings of 3 old weedies, recorded at Augusta (mouth of the Blackwood River, amongst flotsam from international ships), Hopetoun and Denmark, the latter two sightings after storms. Five sightings of live beached seadragon have been recorded to date, two from Augusta (one of these from the mouth of the Blackwood River) and Dunsborough foreshore in the LNE Bioregion; Billy Goat Bay near Geraldton in the CWC Bioregion, and Wylie Bay, Esperance, in the WA South Coast Bioregion. All of these records referred to single specimens sighted. Almost all of the sightings to date have been recorded between 1998 and 2002, although there are 7 records from earlier years (1990 to 1997). To date, no “mass seadragon mortality” events have been recorded in the Western Australian Dragon Search database.

Beachwashed seadragons have been recorded from more than 80 locations along the Western Australian coast. The table below shows some of the main locations in each Bioregion where beachwashed specimens have been recorded. In addition, single sightings have come from Nuytsland Nature Reserve in the Eucla Bioregion (i.e. Great Australian Bight); and from Hummock Island and southeast of Pelsart Island in the Abrolhos Islands (Abrolhos Bioregion).

### 7.1 WSC Bioregion Beachwash Sightings

Marker	No. Beachwashed Specimens Recorded
<i>Bremer Bay</i>	34
<i>Esperance</i>	15
<i>Denmark / William Bay</i>	8
<i>Albany</i>	8
<i>Torbay</i>	5
<i>Hopetoun</i>	5

Within the WSC Bioregion, around 34% of the beachwash sightings from that Bioregion have come from beaches around Bremer Bay, and 22% from sites near Esperance. Single sightings have come from Walpole, Point Ann (near Jerramungup), and Cape Riche.

### 7.2 LNE Bioregion Beachwash Sightings

Marker	No. Beachwashed Specimens Recorded
<i>Rockingham</i>	7
<i>Perth</i>	6
<i>Augusta</i>	4
<i>Margaret River</i>	4
<i>Rottnest Island</i>	3

Within the LNE Bioregion, around 27% of the beachwash sightings from that Bioregion have come from sites near Rockingham, such as Warnbro Beach, and 17% have come from beaches in the Perth area. Two records (4 seadragons) have been reported from the mouth of the Blackwood River, near Augusta. Single sightings have come from Waikiki, Binningup, Bunbury, Stratham and Gracetown.

### 7.3 CWC Bioregion Beachwash Sightings

Marker	No. Beachwashed Specimens Recorded
<i>Hillary's Boat Harbour</i>	8
<i>Perth</i>	7
<i>Grey</i>	4
<i>Geraldton</i>	2
<i>Jurien</i>	2

Within the CWC Bioregion, around 30% of the beachwash sightings from that Bioregion have come from sites near Hillary's Boat Harbour, a popular recreation and tourism area north of Perth. Around 22% of CWC beachwash records have come from beaches north of Perth (see table above). Single sightings have come from Dongara, Illawong, Jurien Bay, Thirsty Point (near Cervantes), and Ledge Point Beach (south of Lancelin).

## 8. Other Data (Depth of Sightings; Water Temperature)

To date, 240 reports of weedy sightings have provided depth recordings. The recorded depth range of weedy sightings reported by divers and snorkellers to date has been 2m to 36m, with around 91% of sightings occurring in waters between 2m and 12m, and few sightings recorded at other depths within the range.

Excluding a single beachcombing record from 1m depth at Bremer Bay, the most shallow records (2m) of weedies reported in the database to September 2002, have come from snorkelling at various sites off Cottesloe, Flinders Bay

(near Augusta), Dunsborough, Gracetown, Albany, and Esperance, and from shallow dives at Ringbolt (near Augusta), Bunker Bay (Cape Naturaliste) and a boat ramp at Albany. Records of weedy sightings by snorkellers have ranged from 2m to 11m.

Records of weedy sightings from 20m and deeper have come from sites at the Mindarie Keys Marina (20m); Bremer Bay (22m); Lucky Bay near Esperance (25m); near Breaksea Island off Albany (record from pilchard fishing at 28m), and the Steep Rock dive site off Esperance (36m). The published depth range for weedies on the southern Australian coast is between 1m and 50m (Kuitert 2000; Edgar 2000).

There are 108 records of leafy sightings for which depth was listed by diving, snorkelling and sightings by other means, and to date, records have ranged from 1m to 19m. Snorkelling records during which leafies were sighted have ranged from 2m to 13m. Records of leafy sightings from 10m – 19m have come from Bremer Bay (24 records); Albany; Rottnest Island (7 records); the Esperance area (6 records); Bunbury (3 records); beaches around Perth (3 records); Garden Island; and Marmion Marine Park. The deepest depths at which leafies have been recorded in the WA database include dive sites at Bremer Bay (4 records from 19m), and a site in the Marmion Marine Park (also at 19m). The shallowest records have come from the Port Denison area (one leafy sighted from the beach, in 1m of water), and from Big Rat Island in the Abrolhos (1 leafy sighted during a dive at 1m). One published depth range for leafies on the southern Australian coast is between 4m and 30m (Edgar 2000). Kuitert (1993 and 2000) also reported that in WA, leafies are usually sighted in water deeper than 20m. However, for 16 of the 108 records of leafies for which depth was recorded in the WA database, the reported depth was between 1m and 3m, and none of the 108 records reported leafies being sighted at depths over 19m, despite 11 such records having maximum dive depths of 20m or above (max 25m). Considering the prevalence of WA leafy sightings in shallow waters less than 20m, commonly observed depths for Western Australian leafies reported in popular marine fish identification guides, should perhaps be revised.

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 are influenced by the depth of benthic habitat features of interest to divers, and the depths of dive sites where weedies and leafies are known to occur, which encourages repeat dives at those locations and hence at particular depths.

Similarly, little can be inferred about seasonal depth variations in seadragon distribution from available data. This is for several reasons, including the facts 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 for some divers', 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"/ rock wall etc. That is, sea dragons 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 (i) the prevalence of diving from late spring to early autumn, (i.e. pleasant diving conditions), especially during the summer holiday months, and (ii) the under-representation of winter sightings. Of the records for which a date was recorded, around 48% of sightings by diving, snorkelling and other means (excluding beachcombing) were recorded in summer; 24% in autumn, and 21% in spring, compared with only 7% in the winter months. 173 records of weedy sightings have reported water temperature, which has ranged, to date, from 14°C to 28°C. Within the range, around 94% of weedy sightings for which temperature was recorded, were made in waters between 17°C and 23°C, with few records at cooler temperatures, due to preference for spring, summer (particularly) and autumn diving conditions. To date, the highest reported water temperature in which weedy seadragons were sighted was 28°C, recorded at 3m depth at North Mole, Fremantle in January 2001. The lowest temperature in which weedy seadragons have been sighted to date was 14°C, supposedly recorded at Cottesloe in shallow water (3m) in February 2000, although it is noted that this is an unusually low water temperature for the middle of summer in mid-Western Australian waters, and may be an erroneous recording. Similarly for leafies, recorded temperature for sightings to date has ranged from 16°C (from a dive at 4m depth, near Nanarup on the south coast, in October 1998) to 25°C (from diving at 8m depth, at Fremantle, in January 2000; and from a dive at 2m depth, at Marmion, in December 1998). Around 92% of the 74 records of leafy sightings for which temperature was recorded, ranged between to 17°C and 23°C.

There is an aggregate record in the WA database referring to a total of 10 adult weedies and 1 juvenile observed at around 4m depth, between 30/04/99 and 05/05/99, whilst the recorder was snorkelling at Flinders Bay (near Cape Leeuwin). The recorder reported that the water temperature was high (24 °C) during this autumn period.

## 9. Sites of Particular Note

Apart from the most northerly reports of leafies, discussed in Section 2 (**Bioregional Distribution of Sightings**), other sightings of particular importance include the following:

**Bremer Bay:** Beros (2000) reported that a television channel filmed both weedies and leafies at Bremer Bay in 2000 for a local TV program, and that other media at the time included a team of Singaporean and New Zealand journalists, viewing the seadragons to write magazine and newspaper stories, with photographs, about the area and the seadragons. A professional underwater photographer also visited Bremer Bay in 2000, for a subsequent story with photographs in 'Asian Diver' magazine. SCUBA Australia reported in 2002 that in addition to the prolific fish and invertebrates at a particular reef near Bremer Bay, the main attraction is the leafy seadragons, and that promotion of this site in a television program (see above) apparently resulted in the large group of leafies being poached. SCUBA Australia also reported that the leafies are now being seen again in the area, but in lower numbers, and that the site is popular for photographing seadragons. In May 2002, a Dragon Search reporter stated that the recording of leafies at the said reef in Bremer Bay around that time was the first sighting in the area for 12 – 18 months.

**Cottesloe Reef and Surrounds:** To date, there have been 12 records of weedy seadragons sighted at Cottesloe, and 2 records of leafies. This is a socially important area for seadragons, particularly weedies, and a local environment group (the Cottesloe Marine Protection Group) has been working since 1998 to: protect the biodiversity of the reef system at Cottesloe; increase scientific research into human impacts in the area; increase public recognition of the significance of Cottesloe's seagrass beds and limestone reef system for seadragons (including its role as a breeding area for weedy

seadragons and nursery area for Port Jackson sharks), and campaign for the weedy seadragon to be protected under WA legislation (Beros 2000, McCauley and Macintyre 2002). The Cottesloe Marine Protection Group has adopted the weedy seadragon as its logo (Beros, pers. comm. 2003). According to McCauley and Macintyre (2002), the Cottesloe reef system is one of only two reef systems that exist along Perth's metropolitan coastline, and stretches intermittently for approximately 4.4 kilometres from Cable Beach to North Street, Cottesloe. It is located on a 1.5 kilometre wide limestone shelf, which is locally known as the Cottesloe Fringing Bank. The Cottesloe Marine Protection Group, formed by a group of local snorkellers, has been concerned about human impacts such as recreational spearfishing, damage from boat anchors, collecting of marine biota and rocks, and discharge of nutrient-enriched stormwater and groundwater in the area. The coastal discharges have promoted the excessive growth of nuisance green algae, which was smothering seagrasses and reefs in the area, particularly during the late 1990s. The group has been working with the WA government to generate awareness of the problems, and to improve management of the impacts. McCauley and Macintyre (2002) reported that following several years of successful campaigning, public and school education programs, media promotion, and preparation of a detailed management plan, there is now a great sense of community custodianship, and a strong public interest in helping to preserve the area for the long term. The Cottesloe Reef area has recently been declared a Fish Habitat Protection Area under WA Fisheries legislation, and is managed by the local community. The area is considered to be a valuable public asset and tourist destination, and also has important recreational, education, Aboriginal and European heritage values.

**Other Sites in the Near-Perth Metropolitan Area, and Fremantle:** To date, apart from the Cottesloe sightings mentioned above, there have been 9 sightings from the local metropolitan area near Perth (LNE Bioregion), including areas such as City Beach, Floreat, Swanbourne, Mosman Park, and Hale Road. Sites further north of Perth, in the CWC Bioregion, such as Trigg Beach, Scarborough, Marmion, Sorrento and Hillary's Boat Harbor, are not discussed in this section, although they are also important sighting locations, with a total of 34 records, 30 of which were weedy sightings and the remainder was leafy sightings. Surprisingly, there have been two records from the Swan River, one referring to a live weedy adult observed during a dive at 12m the Swan River at Mosman Park, which is more than 6 km from the sea, and one record of 2 leafies observed closer to the mouth of the Swan River, near Fremantle. If verifiable, the record from Mosman Park represents the only true river sighting of a live seadragon to date, during the Dragon Search program in any State. There are 35 records in the WA database from Fremantle, especially from North Mole and South Mole, which are popular metropolitan diving sites where the Swan River meets the Indian Ocean. These metropolitan area sightings are significant, because there are few areas in southern Australia where seadragons are commonly observed in the metropolitan waters, close to the city, beaches and ports of high human usage, and numerous pollution sources. The importance of such developed areas for seadragon populations should be considered in the management and mitigation of urban pollution sources, and in local coastal marine development plans.

## **10. Seahorse and Pipefish Sightings**

Seahorses were reported in 9 of the sightings. Seahorses have been recorded from Bremer Bay; Busselton jetty; Palm Beach (near Rockingham, where a Western Australian sea horse was sighted); Warnbro (near Rockingham - a beachcombing record); south-west of Breaksea Island near Albany (where 36 western seahorses were caught in a purse seine fishing net in July 1998, and released alive); Catherine Point (Fremantle – seahorse caught in fishing net and returned alive to sea); and North Mole (Fremantle – 2 sightings). Pipefish have been recorded from:

- Explosives Reef Corner near Geraldton;
- Busselton jetty (reported to be *Vanacampus poecilolaemus*, the Longsnout Pipefish, which is known from a few locations in S.A. (e.g. Gulf St Vincent and Kangaroo Island), and also northern Tasmania and WA;
- 5 locations in Bremer Bay (10 sightings, including one in which “several baby pipefish” were observed during the dive; and two sightings in which dead pipefish were reported, one of which referred to “lots of dead pipefish observed during November and December 1999”);
- Frenchmans Bay, Albany (2 records: 12 pipefish observed whilst snorkelling, in March 1999; and 3 pipefish collected from a beach in the area during the same month);
- Vancouver Peninsula, across from Mistaken Island near Albany (more than 20 dead pipefish collected in January 2000): the record specified pipefish that were “dark with blue spots”, which may refer to any of three species of *Vanacampus*, for which southern WA is part of the range, these being *V. margaritifer* (Mother-of-Pearl Pipefish), *V. poecilolaemus* (Long-Snout Pipefish), or *V. phillipi* (Port Phillip Pipefish) (Kuitert, 1993, 2000);
- South Mole near Fremantle (sawtooth pipefish).

It is possible that the sightings of aggregations of dead pipefish on beaches during late 1999 and early 2000 may relate to conditions that precipitate mass fish kills, such as oxygen depletion of near surface waters following summer micro-algal blooms; or unusually rough sea conditions.

## 11. Other Notable Species

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

- 5 records of wrasse species, from reefs off Hopetoun (3 sightings, one of which specified Maori wrasse); Tanker jetty at Esperance, and a site near Three Mile Reef (Sorrento).
- western foxfish (near Three Mile Reef);
- groper (Tanker Jetty, Esperance);
- 2 sightings of dolphins (Cape Peron near Rockingham and Little Wharton Bay near Esperance);
- ray species (Mettams Pool, near Trigg Beach; and a site near the Marmion Angling and Aquatic Club).

## 12. Historical Records (pre - Dragon Search)

The majority of records in the Western Australian database to date were collected between 1998 and 2002. A small number of older records include the following:

- (i) 2 records from 1985 (1 SCUBA sighting of a weedy at Carnac Island, and 1 record of an adult and juvenile weedy and a juvenile leafy caught in a prawn trawl net at 20m, off Garden Island);
- (ii) 3 diving records from 1988 (= 1 brood male weedy sighted at a beach in the Albany area; 1 record of 50 juvenile leafies recorded in 2m of water at Fremantle, and 2 weedies recorded near Hillary’s Boat Harbour);
- (iii) 3 records from 1989 (= 1 record of 4 brood male weedies and 4 leafies caught in a purse seine net off City Beach near Perth; 1 weedy sighting from a reef near Cottesloe; and 1 brood male weedy sighting from Cape Peron near Rockingham);
- (iv) 1 beachcombing report from July 1990, of a weedy adult recorded south-east of Pelsart Island (Abrolhos Islands area);
- (v) 6 records from 1991 (all of weedy sightings, from Geordie Bay at Rottnest Island; Garden Island; Penguin Island; and sites around Fremantle);

- (vi) 2 records from 1992 (both from the Fremantle area, referring to a weedy adult sighted during a dive in July, and a snorkelling record of a weedy sighted in December);
- (vii) 8 records from 1993 (7 of which were weedy sightings, including the aggregate record from Cottesloe discussed in other parts of this report; 4 of the weedy records were from Fremantle, 2 were from Cottesloe and 1 was from a beach near Margaret River. The leafy sighting was from Fremantle);
- (viii) 12 records from 1994 (= 10 records of weedy adults, 4 of which came from Fremantle, 2 from the Esperance area, 1 from Dunsborough, and 1 record each from Yanchep, Cottesloe and Mullaloo; plus 2 records of leafy adults from Bunbury and Esperance);
- (ix) 10 records from 1995 (= 8 records of weedies, sighted at Bunbury, Busselton, Rockingham, Carnac Island, Fremantle and Geraldton area, and 2 records of leafies, from Marmion Marine Park, and south of Port Denison);
- (x) 6 records from 1996 (= weedy sightings from Busselton, Garden Island and Marmion; and leafy sightings from Cape Naturaliste, Cottesloe and Billy Goat Bay near Geraldton); and
- (xi) 8 records from 1997 (6 records of leafies, from Swanbourne Beach near Perth, Rockingham, Rottnest Island, Port Denison, Geraldton area, and Onslow (the latter possibly a sighting of a Ribboned Seadragon / Ribboned Pipehorse); and 2 weedy sightings from Bremer Bay and Grey).

Apart from the above records included in the Western Australian Dragon Search database, the WA Museum has provided 182 additional, more historical, records to Dragon Search. These records describe an assortment of leafy and weedy seadragon sightings, mainly from Western Australia, recorded between 1931 and 1992. The following summarises historical records of note from Western Australia, according to location (from north to south):

- (i) *Geraldton*: 3 weedy sightings, recorded between 1935 and 1947;
- (ii) *Yanchep Beach*: 1 leafy sighting, from 1968;
- (iii) *Hillary's Boat Harbour*: 25 sightings of leafy seadragons, recorded between 1990 and 1993;
- (iv) *Waterman*: 4 weedy records (1932 - 1942);
- (v) *North Beach*: 2 records of leafies (not dated); 9 sightings of weedies, recorded between 1932 and 1952;
- (vi) *Scarborough*: 13 sightings of weedies (1934 - 1952);
- (vii) *Wembley*: 3 weedy sightings (1 from 1939, and 2 from 1955);
- (viii) *City Beach*: 10 sightings of weedies (1932 - 1951);
- (ix) *Cottesloe*: 1 leafy sighting (number of animals not specified), and 33 records of weedies (mostly undated);
- (x) *Rottnest Island*: 2 records of leafies (one in 1934, one date unknown), and 1 record of a weedy sighting (1931);
- (xi) *Leighton / Fremantle area*: 1 leafy seadragon recorded from North Fremantle (date unknown); 6 records of sightings of single weedy seadragons, from the Leighton Beach area (1 record reported in 1932; 3 records from August 1954; 1 record from September 1955, and 1 of unknown date); 8 records of weedies from the Fremantle area (1 from 1935; 1 from 1940; 2 from November 1952, and the rest of unknown date);
- (xii) *Carnac Island and Garden Island*: 1 weedy sighting at Carnac Island (1932) and 3 weedy sightings at Garden Island (1 from 1956, and 2 from 1972);
- (xiii) *Bunbury*: 5 weedy sightings (including 2 from 1931);
- (xiv) *Flinders Bay*: 2 weedy sightings (1 from 1933);
- (xv) *Albany*: 15 weedy sightings recorded between 1939 and 1964, and 1 sighting from 1988;
- (xvi) *Michaelmas Island*: 4 weedy sightings (from 1959);
- (xvii) *Esperance*: 2 leafy sightings (1973 and 1986), and 3 weedy sightings (1931, 1957, 1986).

## Acknowledgements

In particular, Dragon Search thanks Dennis Beros, from Australian Marine Conservation Society WA, for collating the records, maintaining the database, providing many of the geographical coordinates, and promoting Dragon Search in WA. The Dragon Search program also thanks the WA Museum, and the various organisations, government programs and companies listed on page 1, which have supported and/or promoted the Dragon Search program in Western Australia.

## References

Australian Museum (2002) *Australian Museum Fish Site*. <http://www.amonline.net.au/fishes/>

Beros, D. (2000) WA Update. *The Dragon's Lair*. Newsletter of the National Dragon Search Project. Volume 4, Number 2, July 2000.

Edgar, G. (2000) *Australian Marine Life*. Revised edition. Reed New Holland, Australia.

Hutchins, B., and Swainston, R. (1986) *Sea Fishes of Southern Australia*. Swainston Publishing, Perth, Western Australia.

IMCRA Technical Group (1998) *Interim Mariner 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 and 2000) *Coastal Fishes of South-Eastern Australia*. Gary Allen Pty Ltd., Sydney, Australia.

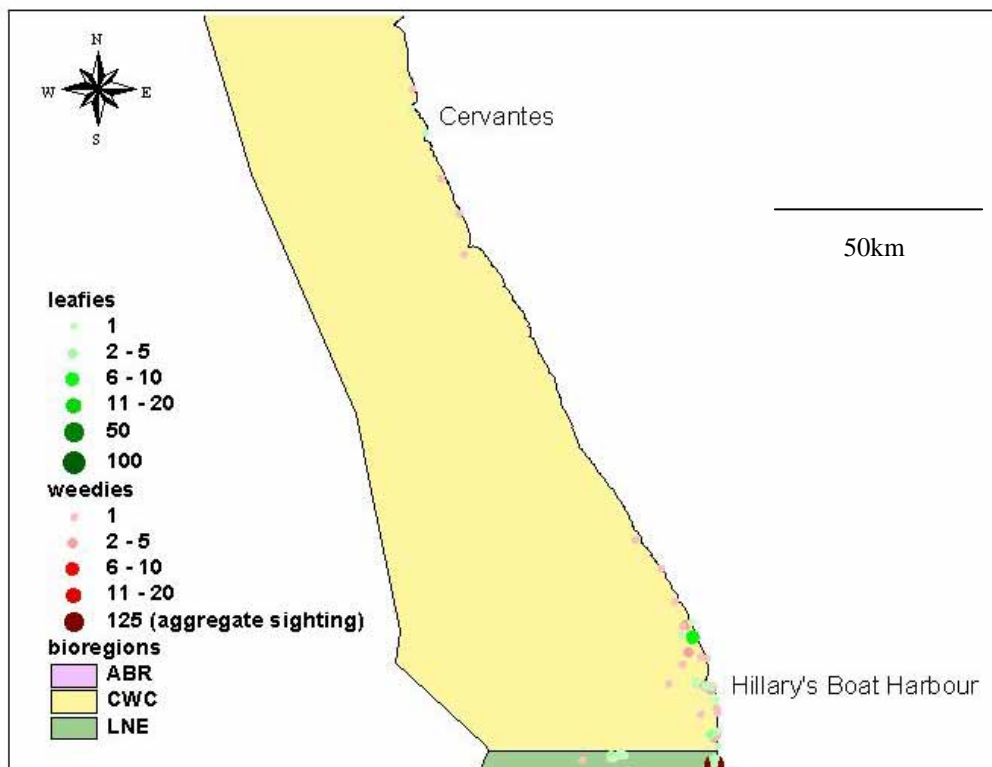
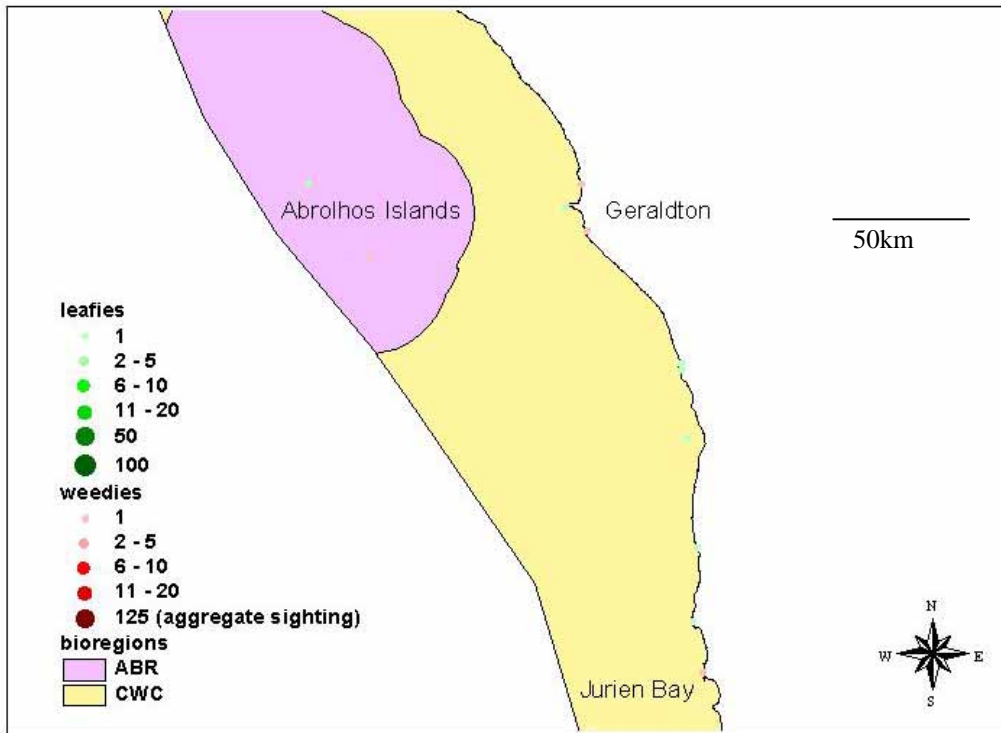
Kuiter, R. (2000) *Seahorses, Pipefishes and Their Relatives. A Comprehensive Guide to Syngnathiformes*. TMC Publishing, Chorleywood, UK. 240p.

McCauley, H. and Macintyre, K. (2002) *Cottesloe Reef: Community Managed Natural Resource*. Article prepared for the Sustainability Policy Unit, Department of the Premier and Cabinet, Western Australia.  
<http://www.sustainability.dpc.wa.gov.au/CaseStudies/Cottesloe%20Reef/CottesloeReef.htm>

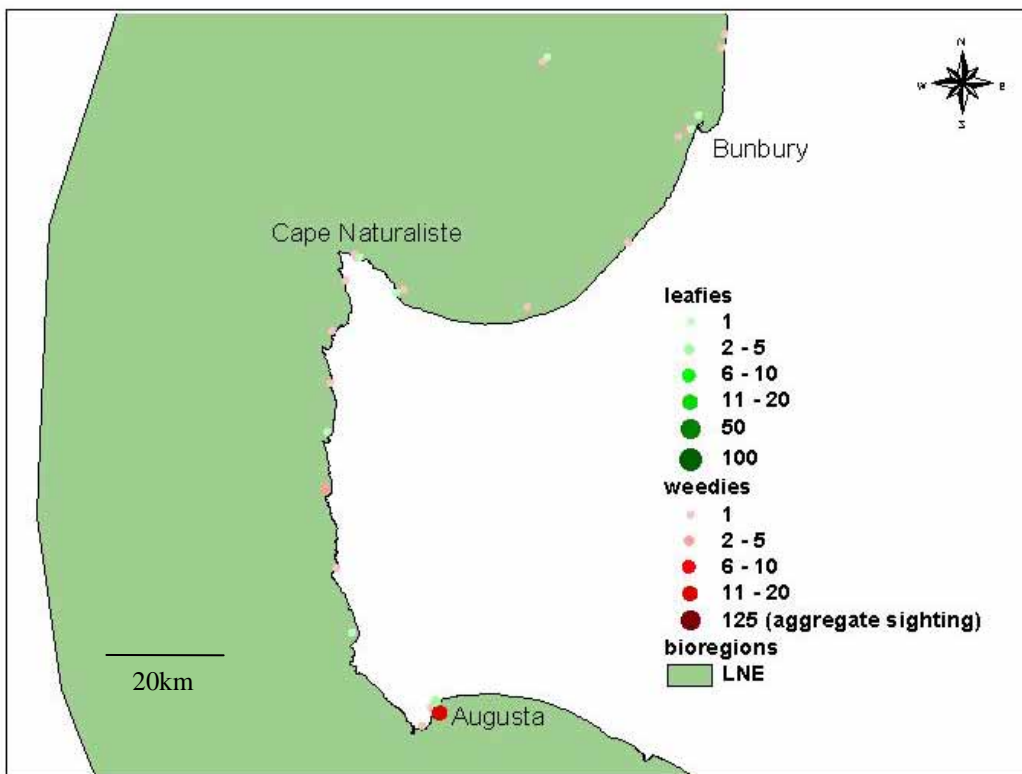
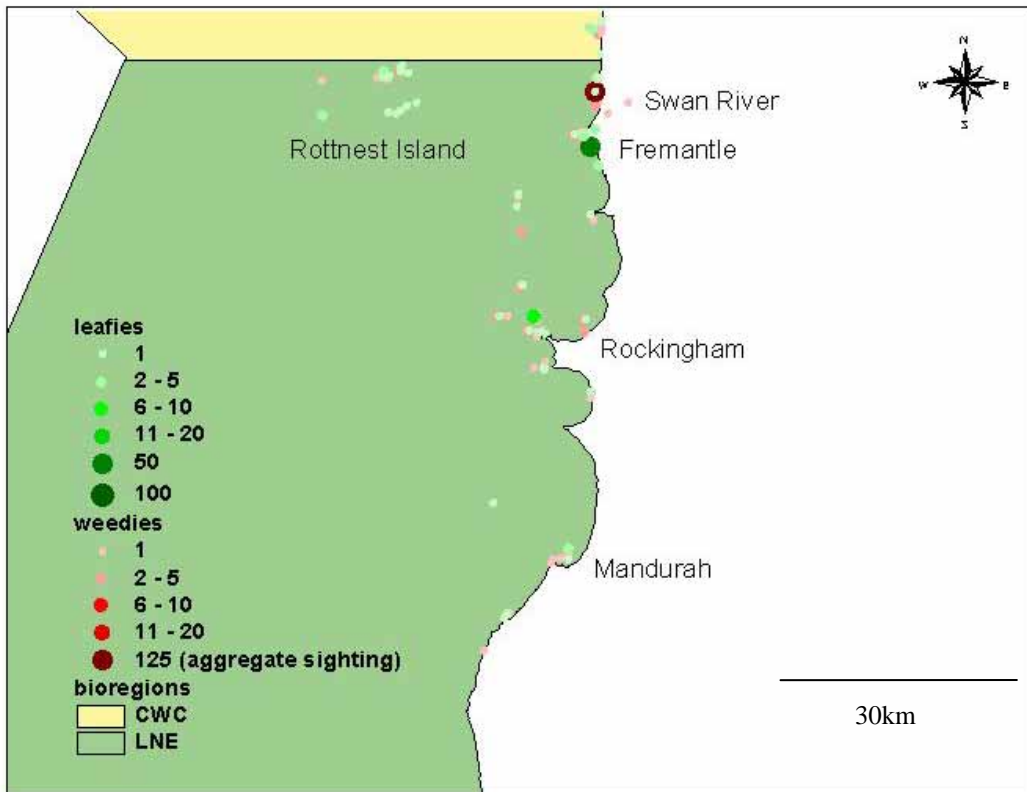
SCUBA Australia (2002) *SCUBA Diving West Australia*. Web pages:  
<http://www.scubaaustralia.com.au/westoz/sa.shr/region/6001>

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.

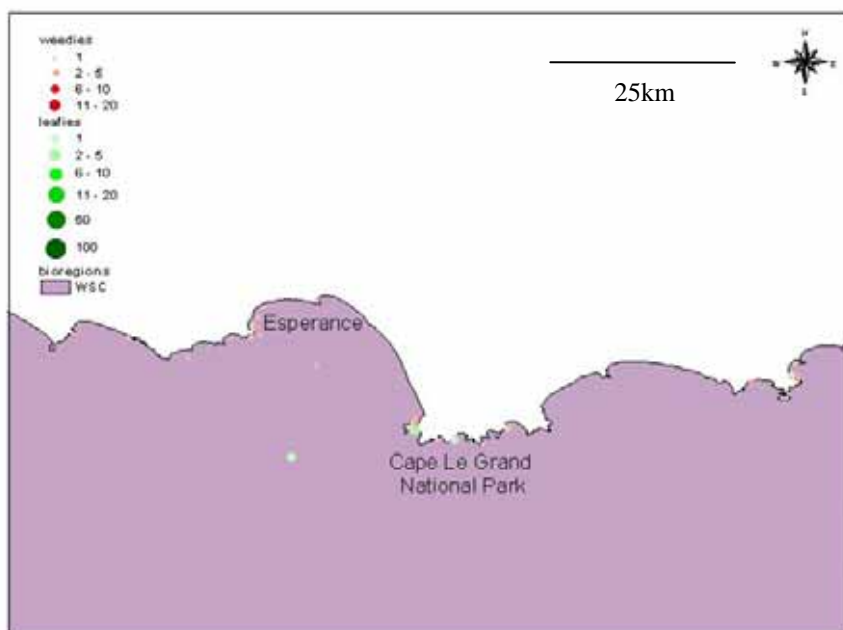
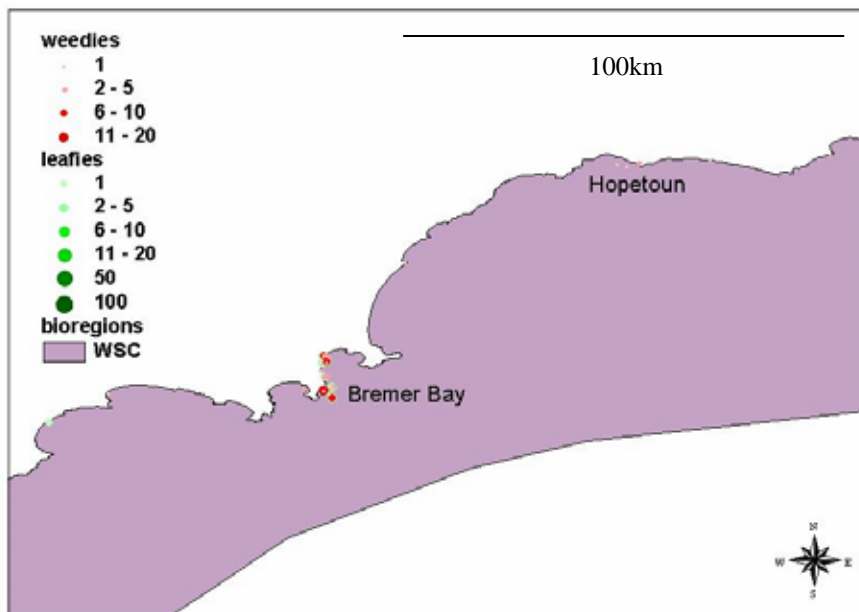
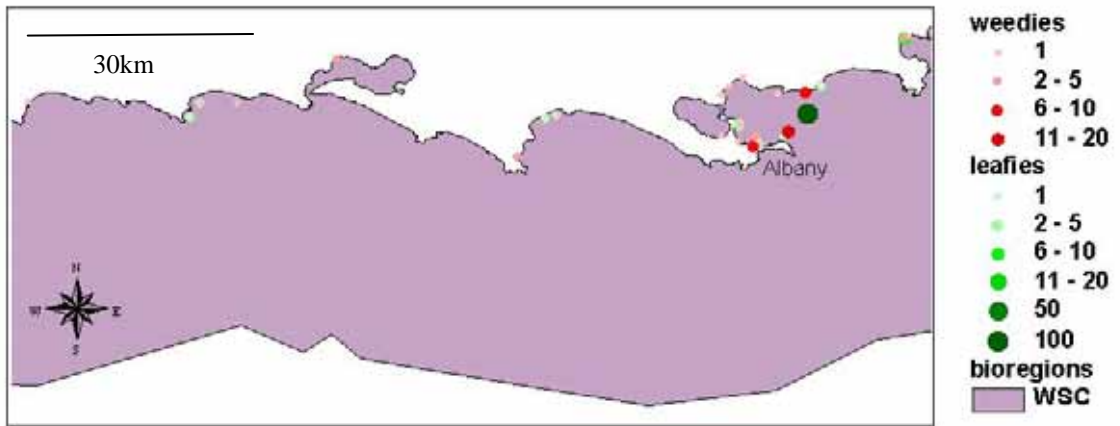




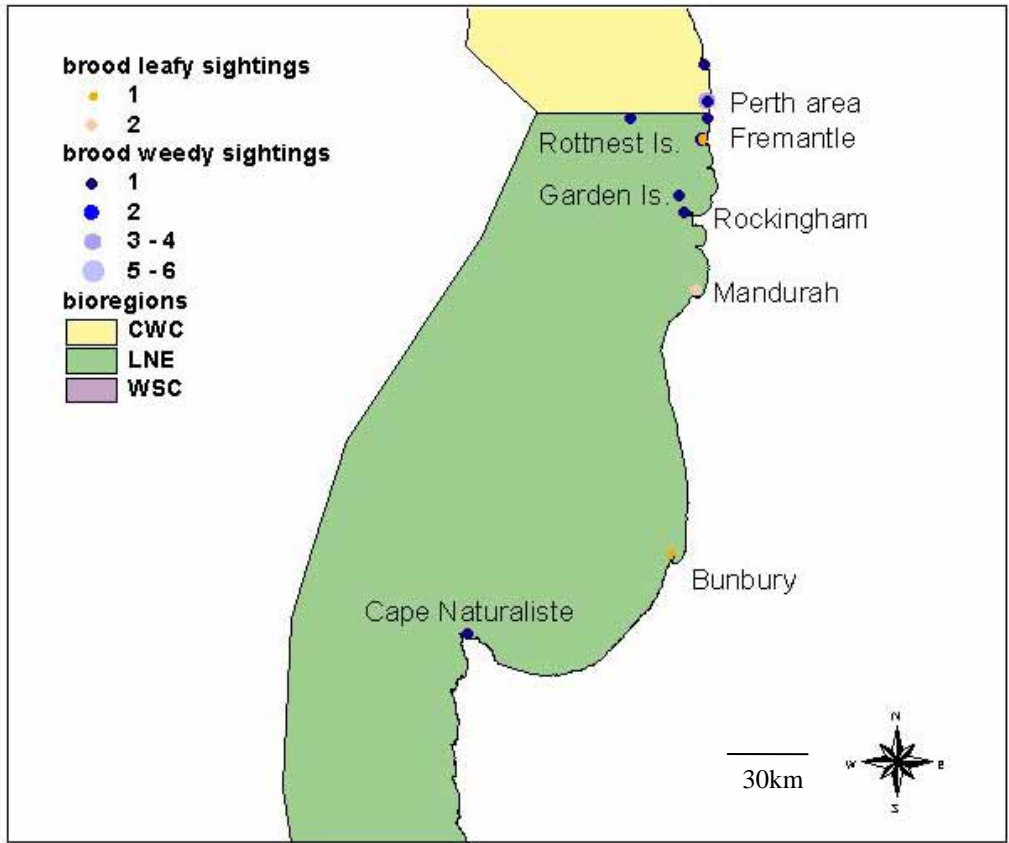
**Maps 1A and 1B: Leafy and weedy sightings in the northern and southern sections of the CWC Bioregion. Map 1A also shows sightings in the Abrolhos Islands Bioregion, offshore from Geraldton.**



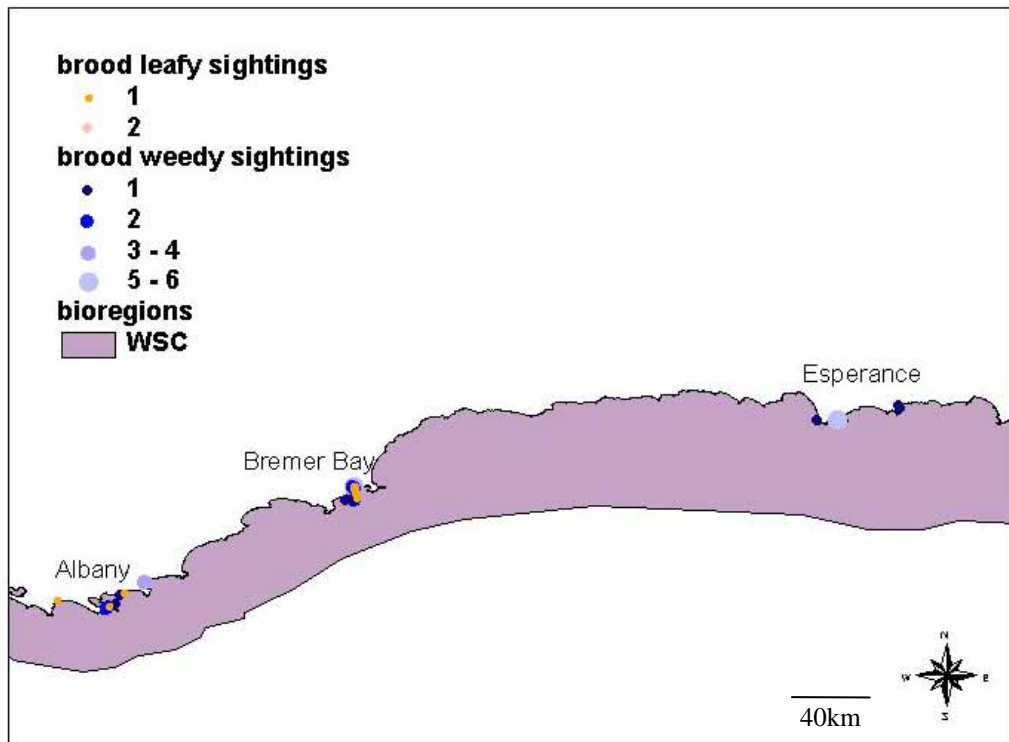
**Maps 2A and 2B: Leafy and weedy sightings in the northern and southern sections of the LNE Bioregion.**



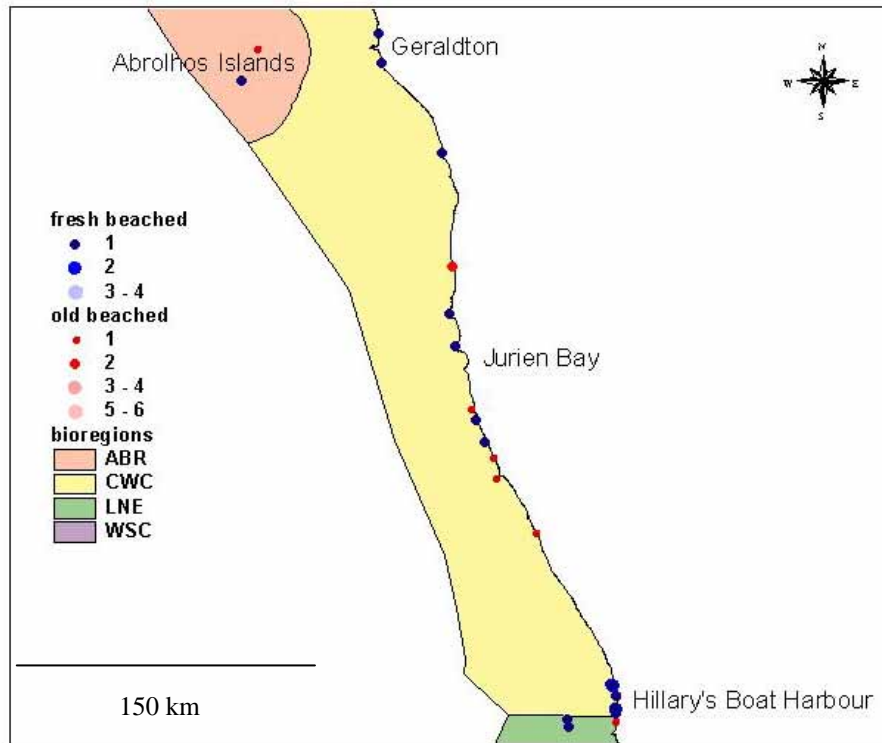
Maps 3A, 3B and 3C: Leafy and weedy sightings in the eastern, central and western sections of the WSC Bioregion.



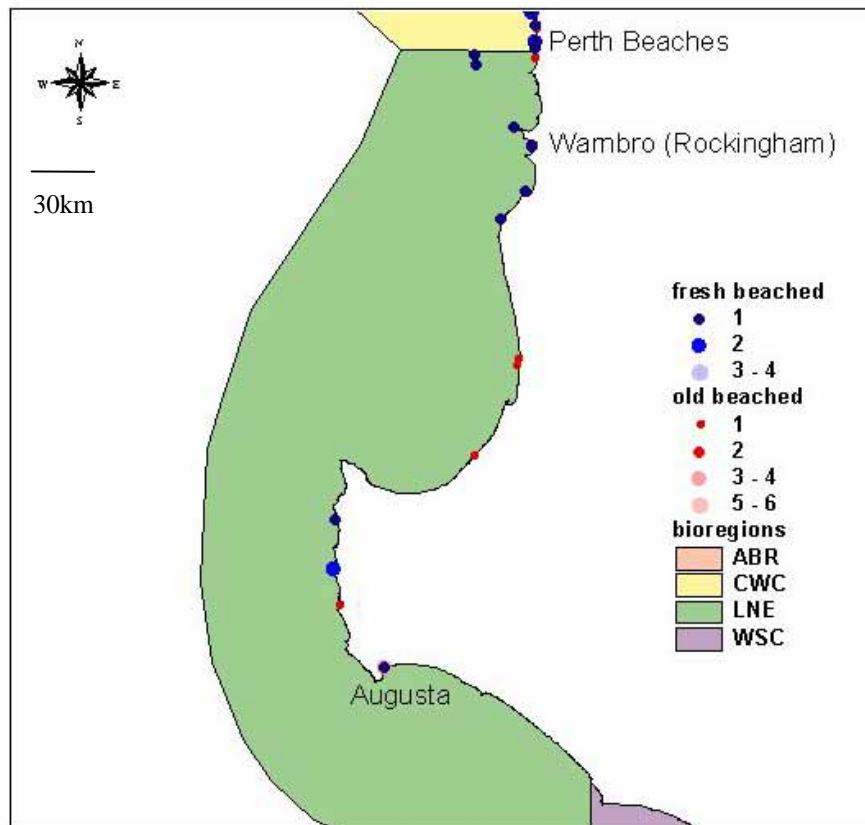
Map 4A: Brood male leafy and weedy sightings in the CWC and LNE Bioregions.



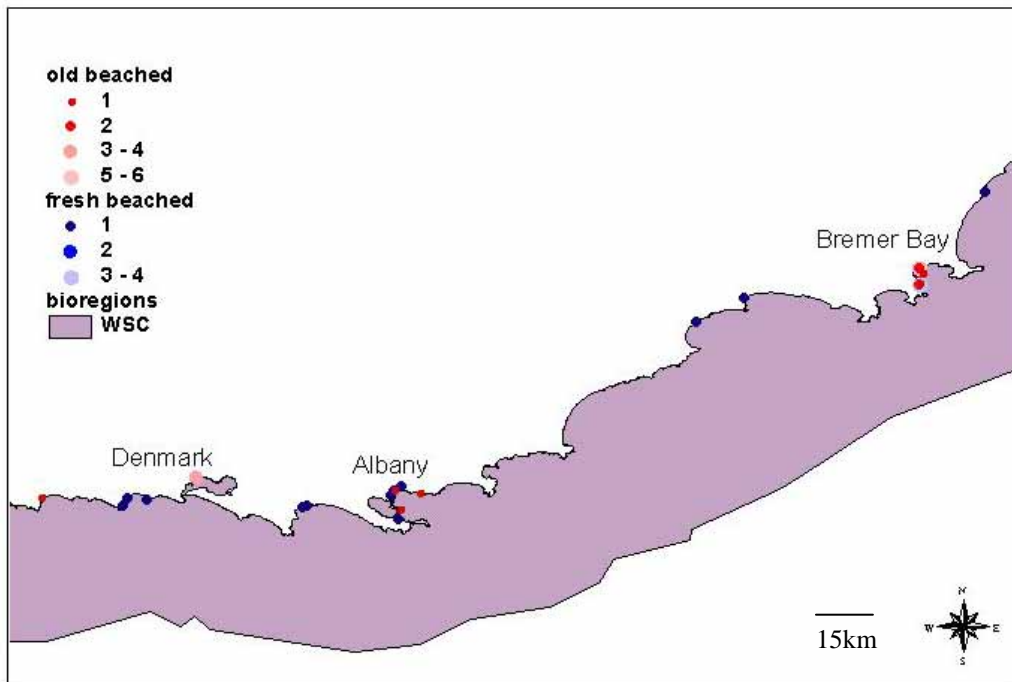
Map 4B: Brood male leafy and weedy sightings in the WSC Bioregion.



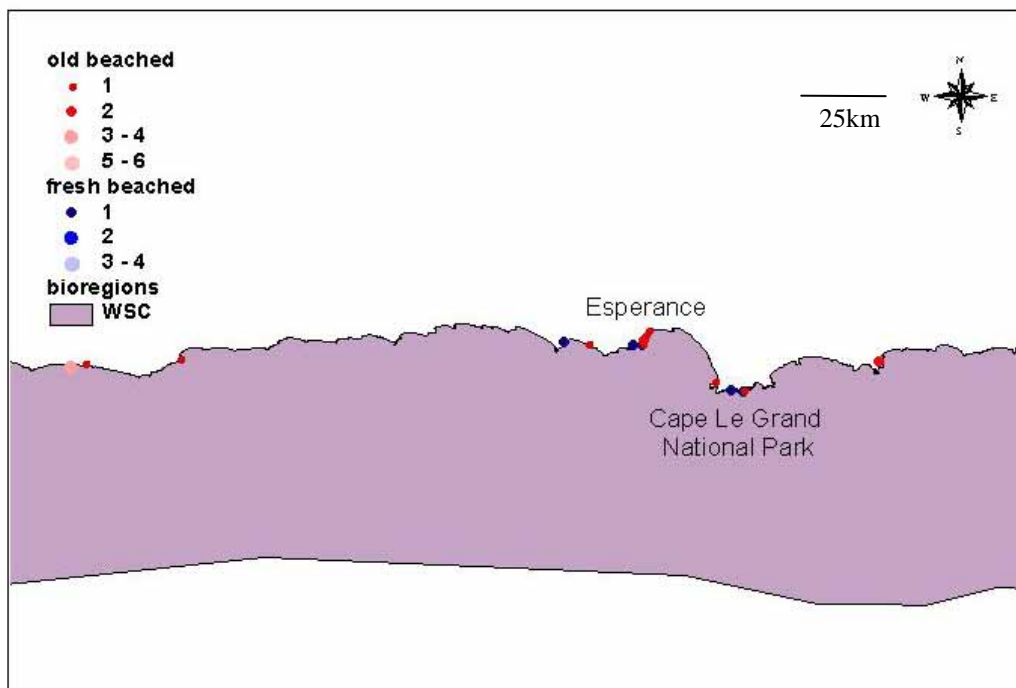
**Map 5A: Beached leafy and weedy sightings in the CWC and Abrolhos Bioregions.**



**Map 5B: Beached leafy and weedy sightings in the LNE Bioregion.**



Map 5C: Beached leafy and weedy sightings in the western section of the WSC Bioregion.



Map 5D: Beached leafy and weedy sightings in the eastern section of the WSC Bioregion.