



# Envirotalk

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GOVERNMENT OF BERMUDA

Department of Environment and Natural Resources

TO PROTECT BERMUDA'S ENVIRONMENT AND RESPONSIBLY MANAGE ITS NATURAL RESOURCES

## WELCOME

to our Winter edition of Envirotalk.

In this issue-

- The Marine Resources team works with MSc student to determine the age of local Spiny lobsters.
- Dr. Mark Outerbridge discusses trimming guidelines for Red and Black Mangroves
- Indigenous plant spotlight: the pectinate passion-flower (*Passiflora pectinata*)
- Also, See:
  - Our **News & Notices** for reminders and upcoming events
  - The **Planting Calendar** to get a head start on what to plant this autumn.

Please contact:

Envirotalk mailing list: [envirotalk@gov.bm](mailto:envirotalk@gov.bm) to be placed on the mailing list or for suggestions for future articles.

## Marine Resources team works with MSc student to determine the age of local Spiny lobsters.

Have you ever wondered how old a big lobster might be? Over the past year, University of Southampton masters student Freyja Kermode worked with Marine Resources Officer, Dr Joanna Pitt, and Fisheries Extension Officer, Jirani Welch, to try to find out how old Bermuda's spiny lobsters really are.

The fishery for the Caribbean spiny lobster (*Panulirus argus*) in Bermuda includes a commercial trap fishery and a licensed-entry recreational diver fishery. A seasonal closure (April-August) during the breeding season and a minimum size limit of 92 mm carapace length (CL) apply to both sectors. The lobster fishery had operated well since the introduction of standard traps in 1996, but recent seasons have seen a notable decline in catches. This could be influenced by a number of factors, including the loss of seagrass beds, which are an important habitat for juvenile spiny lobsters. While size-at-age data can help us understand the life history of marine organisms and inform fisheries management, the detailed demographic data that could be used to demonstrate a problem with lobster recruitment are lacking.

In most fishes, small bones in their ears accumulate layers over time, resulting in annual banding patterns – similar to the rings in a tree trunk – that reflect the age of the fish. Similar growth patterns are also visible in the shells of bivalve species such as clams and scallops. Historically, there has been no equivalent method for directly aging lobsters because they grow by moulting their exoskeleton, and it was believed that the hormones involved in this process resulted in the complete loss and replacement of all hard structures<sup>1</sup>. Therefore, body size (as measured by carapace length – CL) has typically been used as a proxy for age when managing lobster species.

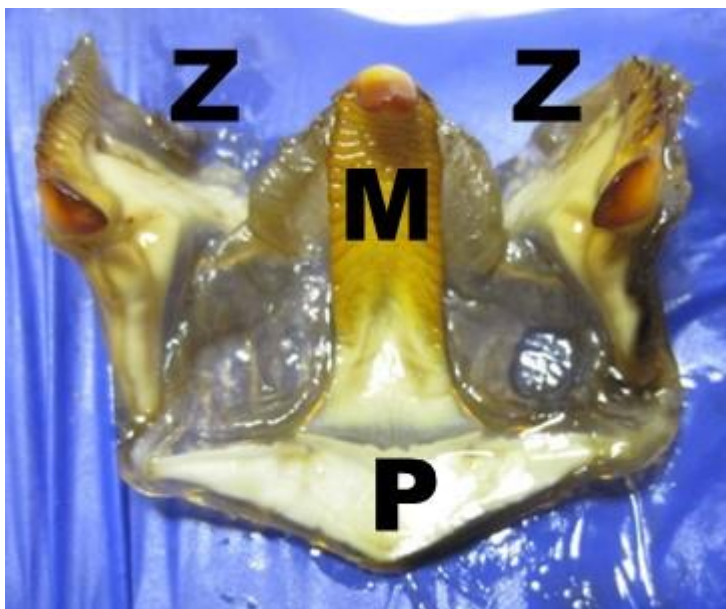


Figure 1. Extracted ossicles of the *P. argus* gastric mill, showing the left and right zygocardiac ossicles (Z), the mesocardiac ossicle (M), and the pterocardiac ossicle (P).

However, recent research has shown that, in at least some species, the bone-like structures (called ossicles) that crustaceans use to grind their food are retained during the moulting process<sup>2</sup>. The discovery of banding patterns in the gastric mill ossicles (Fig 1) of several crustacean species suggested

a promising method for direct aging<sup>2</sup>, and case studies of the Spiny lobster in Florida have shown correlation of band numbers with size and known age<sup>3</sup>. This method was therefore applied to Spiny lobsters from Bermuda to determine whether it could be used to provide insights into the demographics of the local population.

Lobster specimens were collected from both the commercial and recreational fisheries during the 2019-20 and 2020-21 seasons. Carapace length of all lobsters was measured to the nearest millimeter using calipers, and females were identified by the modified dactyl on their 5<sup>th</sup> legs. In all, 76 lobsters were included in this pilot study: 37 males and 39 females. Sampling from the fishery limited the number of small / young lobsters <92 mm CL that could be obtained, but a research permit allowing the landing of undersized lobsters meant that 9 such individuals were sampled. Male lobsters ranged in size from 79 to 157 mm CL, while female lobsters were 76 - 138 mm CL. Ossicles were extracted and prepared according to the methods described in Kilada & Acuña (2015)<sup>4</sup>.

All four ossicles of the gastric mill plate were prepared for the first 10 specimens, in order to compare the banding patterns between them. Banding was identified in all the ossicle structures, but just the zygocardiac ossicles (Fig 2) were used for further analysis. A subset of 30 ossicles was evaluated by multiple readers to assess readability and consistency.

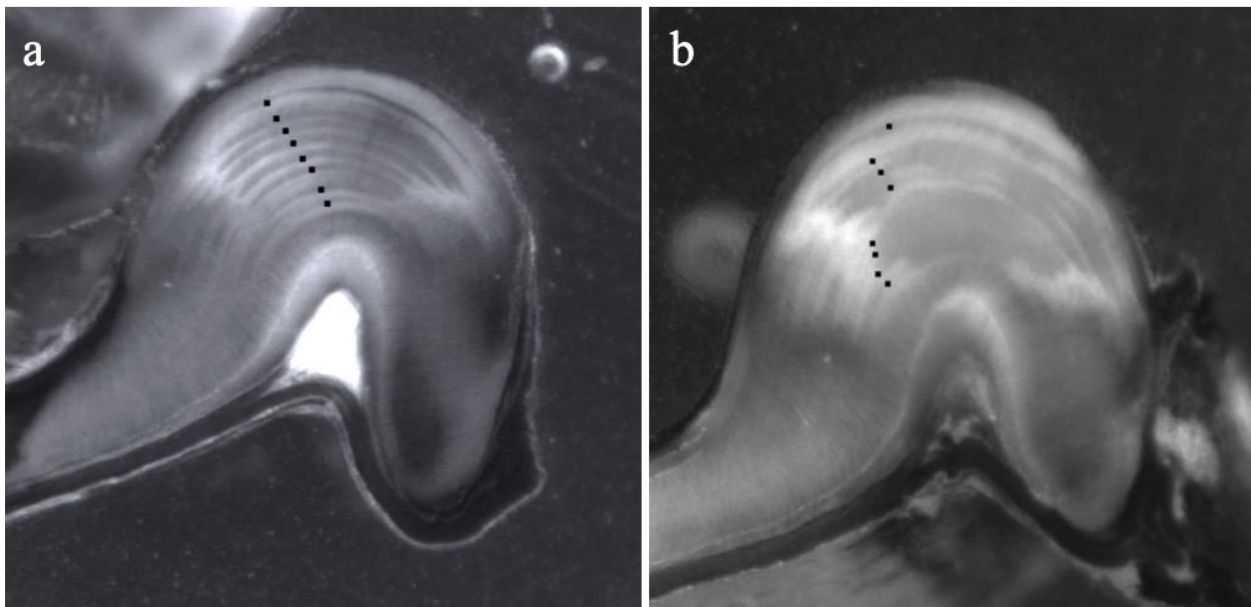


Figure 2. Sectioned ossicles from a 97mm CL female *P. argus* from Bermuda. Estimated age was 8 years based on band counts from the left (a) and right (b) zygocardiac ossicles. Growth bands are indicated by black dots in each image.

The zygocardiac ossicles had more distinct banding than the ptero- and meso-cardiac ossicles. The number of bands visible in the two zygocardiac ossicles was generally consistent (Figs 2 and 3A), while relatively fewer bands were usually discerned in the pterocardiac ossicle (Fig 3B).



Figure 3. Comparisons between age estimates from the two zygocardiac ossicles (A) and between zygocardian and pterocardiac ossicles (B). Solid lines show the regression; dashed lines show parity. Counts between experienced independent readers showed little variation, indicating high reproducibility of this method. Difficulty of reading, assessed on a three-point scale, influenced the accuracy of band counts between readers: variation was greater for ossicles rated as more difficult to analyze.

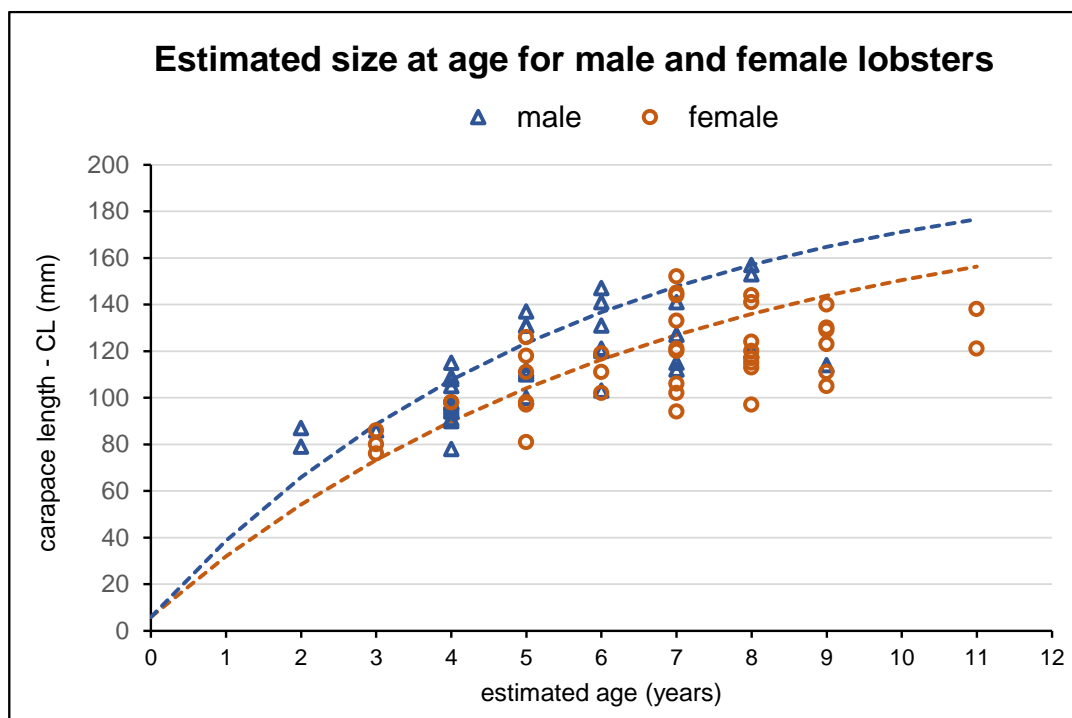


Figure 4. Carapace length (mm) plotted against estimated age in years for male (blue) and female (orange) lobsters. Shown for comparison are typical growth curves for each sex based on data from Evans 1988<sup>6</sup>, in Mateo 2004<sup>6</sup>.

The greatest number of bands, indicating the oldest lobster (!), was 11, in a female of 138 mm CL, while two male lobsters of 79 mm CL and 87 mm CL each had 2 bands. Band counts give a plausible

estimate of age when compared to carapace length, and the size-at-age plots based on these data compare well with typical growth curves based on previous local data<sup>5</sup> (Fig 4). The data indicate larger size-at-age and faster growth for males relative to females (Fig 4), which concurs with established research and observations of size dimorphism in the catch. There was wide variation in size-at-age, with 7 year old female lobsters ranging in size from 94 – 152 mm CL (Fig 4). However, it appears that a 4 year old lobster of average size (98 mm CL) would be recruited to the fishery.

This study suggests that directly ageing Spiny lobsters in Bermuda using zygocardiac ossicle band counts is feasible, and can be used to inform local fisheries management. Importantly, there appears to be considerable variation in size-at-age for both male and female lobsters, implying that size-frequency is not necessarily a reliable proxy for demographics. The next steps for this work involve examining ossicles from additional specimens that include smaller lobsters as well as some recently molted individuals.

#### References

- <sup>1</sup>Cruz R, Bertelsen RD (2008) GCFI 61, 434-446
- <sup>2</sup>Leland JC et al. (2011) Crustac Monogr 15, 57–68
- <sup>3</sup>Gnanalingam G et al. (2018) ICES J Mar Sci 76, 442–451
- <sup>4</sup>Kilada R, Acuña E (2015) Fish Res 170, 134–143
- <sup>5</sup>Evans CR (1988) UK ODA report, 98pp
- <sup>6</sup>Mateo I (2004) GCFI 55, 506-520

## Trimming guidelines for red and black mangroves

Mangrove trees are found growing in two different environments on Bermuda; around marine ponds and in sheltered locations along the coastline. Both red mangroves (*Rhizophora mangle*) and black mangroves (*Avicennia germinans*) are protected, having been listed under the Bermuda Protected Species Order since 2012. As such, they cannot be cut down, uprooted, or heavily trimmed in a manner that causes permanent damage or death. Anyone wishing to do this requires a Protected Species Permit by the Department of Environment and Natural Resources (DENR); however a Permit is not required for the routine maintenance of mangroves. Trimming is allowed provided it is restricted to branches, twigs, limbs and foliage, and is done in a manner that does not remove, defoliate, or destroy the tree.

Some local property owners like to trim mangroves along their shorelines to obtain a view, or enhance their view, of the water. In other instances people wish to prevent obstruction of a dock or to keep access to the ocean open. Mangrove trees can be trimmed, if done properly, in a variety of ways that provides for these reasons while still protecting the health of the tree. The height to which a mangrove tree may be trimmed depends upon the species, its existing height, as well as the overall condition of the tree.

Both the Florida Department of Environmental Protection and the Cayman Islands Department of Environment have published mangrove trimming guidelines in order to assist coastal property owners and landscapers in identifying and trimming mangrove trees in a manner that (1) provides a view or navigational access, (2) protects valuable mangrove resources, and (3) is in compliance with statutory regulations regarding the trimming and alteration of mangrove trees. Readers are strongly encouraged to view these documents online to get helpful advice about the various trimming styles suitable for different mangroves, learn why mangroves are important, and how to identify between the species.

[https://floridadep.gov/sites/default/files/Mangrove-Homeowner-Guide-sm\\_0.pdf](https://floridadep.gov/sites/default/files/Mangrove-Homeowner-Guide-sm_0.pdf)  
<https://doe.ky/wp-content/uploads/2020/04/Mangrove-Trimming-Guidelines.pdf>

This article will simply highlight the most salient points from those publications.

Trimming is best done during the winter months (December-February) when mangrove growth is slower on Bermuda and the plant's energy demand for producing flowers, seeds, and seedlings (technically known as propagules) is reduced, leaving more energy for recovery from the trimming. It's also important not to trim during the hurricane season (June-November) because the trees need all the leaves they can carry in order to generate energy for recovery after being damaged by storm winds. When all, or most, of the leaves are trimmed off of a mangrove, its chances of surviving is severely reduced. Red mangroves and large black mangroves are the most susceptible to death from defoliation. Most of the new growth occurs at the branch tips, and red mangroves lose their ability to bud from older branches on a tree, especially when the diameter of the branch is greater than 1 inch thick.

### **Red mangrove trimming guidance:**

This species is the most susceptible to damage from severe trimming. The following should be remembered when trimming red mangroves:

- They primarily grow from their branch tips (apical meristems); removing most of these can kill a tree.

- They lose their ability to re-sprout new branches from older parts of the tree (i.e. branches greater than 1 inch thick).
- The upper 50% of the canopy of tall (i.e. greater than 24 feet) red mangroves should not be cut.
- They are best cut by trimming 'windows' in the lower part of the canopy, with the bottom of the opening being at least 6 feet from the ground (or mud). This protects the young mangrove saplings growing below the windowed area.



**Black mangrove trimming guidance:**

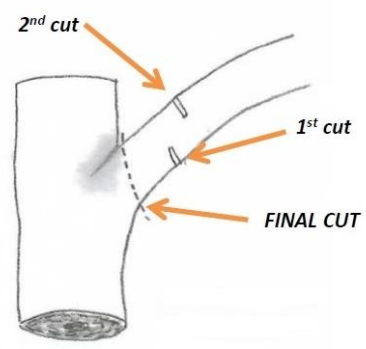
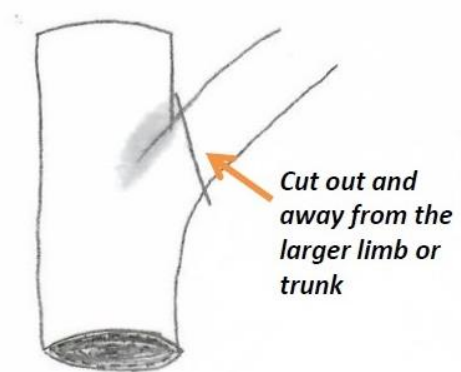


This species handles trimming fairly well, however mature black mangroves are susceptible to excessive trimming and do not recover as well as younger trees. Therefore, the upper canopy of old mature black mangroves should not be removed. Because black mangroves have such strong, dense wood and make effective wind breakers, window trimming is highly recommended, especially on the larger diameter trees.

Please be aware of the following when trimming any mangrove tree on Bermuda:

- Always leave a clean cut, keeping the branch collar in place. Sharp tools produce a smooth cut; frayed cuts may not heal properly and can become a source of infection.
- No mangrove may be trimmed lower than 6 feet from the ground (or seafloor). This does not mean that everyone will be able to trim their mangroves down to a height of 6 feet. If trimming to such a height can be expected to result in the removal, defoliation, or destruction of a mangrove, then a Protected Species Permit from DENR will be required.
- Larger trees need to be pruned in stages over several years in a manner that does not remove more than 25% of the leaves each year.
- Because of their size, mangrove trees greater than 24 feet tall require a Protected Species Permit in order to trim.
- Mangrove roots may not be trimmed. Cutting mangrove roots is considered alteration (rather than maintenance) and shall not be conducted without a Permit.
- Elimination of multiple trunks is forbidden.
- Defoliation is forbidden.
- Hedge-style trimming is not recommended for red mangroves or mature black mangroves.
- For shorelines greater than 150 feet only 65% of the mangrove area (determined by square feet of mangrove cover) may be trimmed. This is necessary to maintain the integrity of the mangrove community.
- Do not use pruning paint on any cuts. They can seal in harmful fungi and bacteria and slow the healing process.
- Herbicides should never be used on mangrove trees and they should be used very carefully on invasive trees growing adjacent to mangroves because they can translocate into the soil and could harm neighbouring mangroves. The Florida Department of Environmental Protection only allows the use of the herbicide ClearCast around mangroves, and DENR is currently assessing this product for importation and local use

For mangrove branches that are less than 0.5 inches thick:



For mangrove branches that are greater than 1 inch thick:



**Examples of excessive pruning:**



## Indigenous plant spotlight: the pectinate passion-flower (*Passiflora pectinata*)



Photo by Ernst Jansen

This delicate, white coloured passion flower is native to the Caribbean where it is frequently found growing on sand dunes and in areas of low scrub. However, on Bermuda this vine was reported to grow only in the rocky areas of Abbot's Cliff, Hall's Island, and the Walsingham area<sup>1</sup>. The common name 'pectinate' refers to the comb-shaped bracts (leaves that branch off from the floral axis). These green coloured bracts are spiny-looking in appearance and 2-3 cm long. The flowers are relatively small (5-8 cm in diameter); each petal is approx. 2-3 cm long and 0.5 cm in width. The oval-shaped leaves are typically 4-7 cm in length and not lobed. Fruits are small, somewhat oval in shape and a rich pink colour when ripe. Apparently locals called them 'apricots' back in the 19<sup>th</sup> and early 20<sup>th</sup> centuries.

This native passion flower hasn't been seen since the 1960s, which has led some to believe that it may be locally extinct. There is a small chance that it could still be living in a few hard-to-reach places on the face of Abbot's Cliff. If this proves true it will give us a wonderful opportunity to propagate it for planting in gardens and nature reserves.

If you think you have seen this rare species growing on Bermuda please send photographic evidence to [environment@gov.bm](mailto:environment@gov.bm).

### References:

1, Britton, N. 1918. Flora of Bermuda. Hafner Publishing Company, Inc. 585 pp.

## News & Notices

### Spearfishing Reminder

Recreational spear fishers are reminded that spearfishing statistics should be submitted **monthly** using the online portal at [www.fisheries.gov.bm](http://www.fisheries.gov.bm). Please call 293-5600 or email [fisheries@gov.bm](mailto:fisheries@gov.bm) if you are having difficulties accessing the portal.

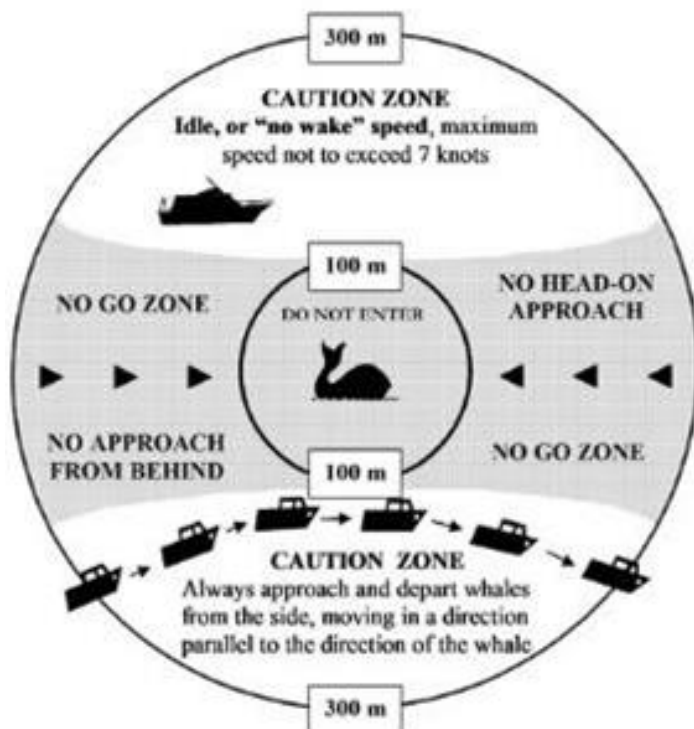
### Lobster Diving Reminder

Now that lobster season is underway, recreational lobster divers are reminded that they should fly a standard red and white dive flag when they are diving for lobsters, and must avoid diving in the vicinity of commercial lobster traps. Catch statistics must be reported using the online portal at [www.fisheries.gov.bm](http://www.fisheries.gov.bm).

Keeping lobster catch statistics up to date through the season helps improve accuracy, particularly when it comes to reporting locations, and avoids a rush or complications as the reporting deadline of **April 30<sup>th</sup>** approaches. Please call 293-5600 or email [fisheries@gov.bm](mailto:fisheries@gov.bm) if you are having difficulties accessing the portal.

### Whale Watching Guidelines

Whale watching can be enjoyed in Bermuda's waters in winter and spring. The public are reminded that all whales and dolphins are protected by law. Boaters should follow the whale watching guidance located at: <https://environment.bm/whale-watching-guidelines>



## Planting Calendar – What to plant in the winter...

### VEGETABLES

#### December

Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cauliflower, Celery, Chard, Chives, Kale, Leeks, Lettuce, Mustard Greens, Onions, Potatoes, Radish, Rutabaga, Spinach, Squash, Strawberry, Tomato, Turnip.

#### January

Beans, Beets, Broccoli, Brussels Sprouts, Cabbage, Carrots, Cassava, Cauliflower, Celery, Chard, Christophine, Kale, Leeks, Lettuce, Mustard Greens, Potatoes, Radish, Rutabaga, Spinach, Squash, Tomato, Turnip.

#### February

Beans, Beets, Broccoli, Cabbage, Carrots, Cassava, Cauliflower, Celery, Chard, Christophine, Corn, Cucumber, Kale, Leeks, Lettuce, Mustard Greens, Potatoes, Pumpkin, Radish, Rutabaga, Spinach, Squash, Sweet Potato, Tomato, Turnip.

### FLOWERS

#### December

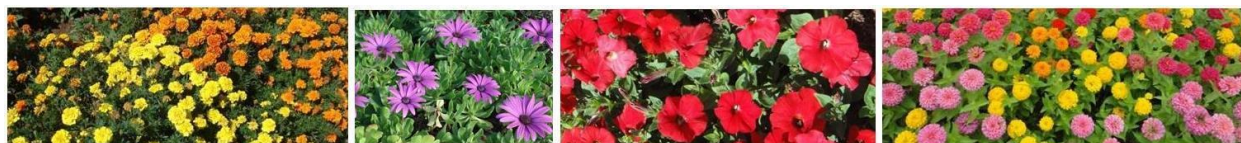
Ageratum, antirrhinum (snapdragon), aster, aubrieta, begonia, bells of ireland, candytuft, carnation, centaurea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salpiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet william, verbena and viola.

#### January

Agratum, antirrhinum, aster, aubrieta, begonia, bells of ireland, candytuft, carnation, centaurea, chrysanthemum, cineraria, dahlia, dianthus, geranium, gerbera, gypsophila, impatiens, larkspur, lathyrus, nasturtium, nicotiana, pansy, petunia, phlox, rudbeckia, salpiglossis, salvia, statice, snow-on-the-mountain, spider flower/cleome, star-of-the-veldt, stock, sweet william, verbena and viola.

#### February

Acrolinium, ageratum, alyssum, antirrhinum, aster, aubrieta, baby blue eyes, bachelor's buttons, bird's eyes, blanket flower, begonia, bells of ireland, calendula, candytuft, carnation, centaurea, chrysanthemum, cineraria, coreopsis, dahlia, Africa daisy, dianthus, forget-me-not, geranium, gerbera, globe amaranth, globe gilia, godetia, gypsophila, hollyhock, impatiens, larkspur, lathyrus, marigold (African), marigold (French), nasturtium, nicotiana, pansy, petunia, phlox, phlox (annual), red tassel flower, rose everlasting, rudbeckia, salpiglossis, salvia, scabiosa, statice, snow-on-the-mountain, spider flower (cleome), star-of-the-veldt, stock, sweet pea, sweet william, verbena and viola.



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