The Beach Plants and Seaweeds of Lido Beach

An Introductory Guide

- Beach Plants
- Seaweeds
- Plant and Seaweed Reproduction

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Best if viewed in full screen mode

Beach Plants

- Importance to Beach Ecology and Plant Characteristics
- Beach Habitats and Adaptations
- Beach Plants by Zone

Importance of Plants to the Beach Ecology

- Stabilize Dunes
  - Root structures help anchor sand
  - Plant structures aid in dune formation
- Provide food
  - Insects feed on plants and flowers
  - Birds feed on fruits and seeds
  - Rabbits and other small mammals feed on plant matter
  - Decaying plants provide nutrients to the beach
- Provide animals and birds with shelter from the elements
- Provide cover for both predator and prey
  - Feral cats move among them

Piping Plovers nesting near grasses

Beetle feeding on goldenrod leaf

Native vs Naturalized vs Invasive Plants (*USDA definitions*)

- **Native** - a plant that has become established in a particular region or ecosystem over hundreds or thousands of years
  - The word native should be used with a geographic qualifier – e.g. native to Lido Beach
  - Only plants found in the U.S. prior to European settlement are considered native

- **Naturalized** - a plant that becomes established in an area where it is not native

- **Invasive** - a 'bad' naturalized plant that is able to grow quickly, and spread to the point of disrupting plant communities or ecosystems

- **Exotic** - a plant not native to the continent on which it is now found

Reed Grass– invasive exotic from Australia

Dusty Miller – naturalized exotic from Asia

Plant Characteristics

- Common characteristics of most land plants include:
  - Presence of chlorophyll used in photosynthesis to convert sunlight and carbon dioxide to food and oxygen
  - Multicellular with cells surrounded by cellulose, which provides structure
  - Require water and sunlight
  - Transpiration – loss of water through leaves

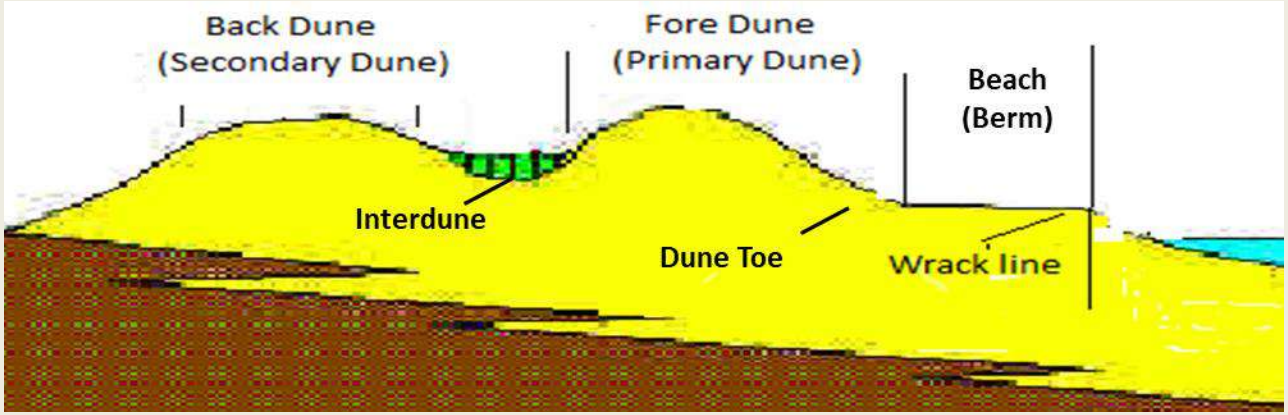
- Common structural characteristics
  - Roots – *gather water and nutrients, provide anchorage*
  - Stems – *convey water and nutrients, provide support*
  - Leaves – *provide food through photosynthesis*
  - Buds – *undeveloped flowers, fruits and shoots*
  - Fruit - *ripened ovary containing seed*

Plants on the beach come in many sizes and shapes

Beach Rose flower and fruit (rose hips)

The Beach is a Harsh Environment for Plants

- Wrack line – marsh grasses and seaweeds washed up on beach - ephemeral, but if trapped above flood line can decay – *providing nutrients and shelter for pioneer plants (first to colonize)*
- Beach (berm)– subject to overwash, periodic inundation, blowing sand, lack of fresh water - *plants do not generally grow on the beach*
- Dune toe and face – less prone to flooding but subject to salt spray, strong winds and blowing sand – *a few specially adapted plant species can grow here*
- Interdune – protected by foredune from wind and spray – *more varieties of plants and denser growth – cooler temperatures and less evaporation*
- Back or secondary dune – further from effects of ocean, more water – *shrubs and trees can be found, esp. on landward side of dune*



Beach Zones

Beach Zones in Pictures

Wrack line - and beach (berm)

Toe of primary (fore) dune – note sparse vegetation

View across interdune – note denser growth and some bushes

View from back dune through dune system to ocean

Back or secondary dune– note dense growth of bushes on dune crest

Plant Adaptations for Beach Survival

Plants have adopted various strategies to survive the harsh beach environment

- Small leaves limit wind impact and water loss *(transpiration)*
- Succulent leaves with a waxy coating *(cuticle)* help to store and limit loss of water
- Grow close to the ground *(prostrate)* to minimize wind impact
- Long, narrow, flexible leaves that can bend with the wind
- Deep root structures to reach available water
- Salt glands help to eliminate excess salt

Waxy, succulent leaves to manage water loss

Narrow leaves that can bend with the wind

Beach Plants by Zone

- Plants of the Foredune
- Plants of the Interdune
- Plants of the back dune and beyond

Plants of the Foredune

American Beach Grass - *Ammophila breviligulata*

- The dominant, most visible, most ubiquitous, most important dune plant of Lido Beach
  - One of a few that are adapted to living on the ocean facing dune
  - Used extensively for the planting of manmade dunes and dune restoration
- Sand binding abilities essential to the formation and health of dune systems
- Beach Grass is protected from human contact as part of the Dune Protection Zones
- Provides important habitat to birds, small mammals and insects
- An essential part of the visual character of the beach – visible year round

Beach Grass on ocean facing dune

Protecting the dunes and Beach Grass

American Beach Grass - Characteristics

- A native perennial
- Roots – can go down over 20 feet in search of water
- Stems - grow horizontally beneath the sand (rhizomes)
  - Culm – short stem which grows above ground
- Leaves - are long (2 to 3 ft.) and narrow – can curl to help prevent water loss
- Flowers – tiny and indistinct, grow on a long 'spike' which originates at the base of the plant

Roots exposed by cut in dune

Culm – short stem of Beach Grass

Spike

Beach Grass Propagation and Sand Dunes

- Propagates primarily by rhizome – it can spread rapidly (6 – 10 feet in a season)

- Natural dune formation occurs when blowing sand hits Beach Grass, falls and accumulates
  - The windblown sand buries the culm (bottom of the plant)
    - This triggers the plant to send up a vertical shoot from the rhizome
    - New shoots can help the dune to grow vertically and horizontally

- Beach Grass is essential to the health of the dune
  - The web of buried roots and rhizomes anchors the sand and dune
  - Compaction resulting from walking in the dunes can damage the buried Beach Grass structures

Note neat row of plants from a shared rhizome

Rhizome protruding from a cut in the dune

Plants of the Foredune

American Sea Rocket – *Cakile edentula*

- A flowering native annual plant – so named because its seedpods resemble a rocket
  - Pioneer plant – propagates by seed
  - Most readily seen inside the sanctuaries along the symbolic string fencing
  - Vehicles, raking and pedestrians can limit survival outside of the sanctuaries
  - Also found on the exposed, sandy sides of the walkways through the dunes

- Sea Rocket seeds can benefit from decaying wrack lines which provide nutrients, anchorage and protection from windblown sand and high tides

- A prominent plant found on the toe of the dune

- Decaying plants add nutrients to the sand for the next generation

Sea Rocket plant

Prominent plant on toe of dune

American Sea Rocket Characteristics

- Waxy, succulent leaves and stems to minimize water loss and effects of windblown sand
- Seedpod has two segments
  - Upper segment floats – it detaches from the plant and can be transported by wind or ocean to colonize another part of the beach
  - Lower segment remains attached – gets buried in sand when mother plant dies to germinate next season in a proven suitable habitat
  - Human assisted seed dispersal can also occur during spring beach grooming
- Sends down taproot and lateral roots to search the sand for water

Taproot and lateral roots

Small lavender colored flowers

Rocket shaped seedpod with 2 segments

Other Plants of the Foredune

Seaside Spurge - *Euphorbia polygonifolia*

- Small, flowering annual native
- Grows low to the sand (prostrate)
- Succulent oblong leaves
- Horizontal reddish colored stems
- Crushed leaves exude a latex-like liquid
- Seed dispersal aided by wind and water

Spurge lying on sand

Close-up incl. flower

Seabeach Amaranth - *Amaranthus pumilus*

- Small, flowering annual native
- Federally threatened plant since 1993 – very rare
- Only 50+ populations remain on East Coast
- Absent for many decades from NY beaches
- Seed dispersal aided by wind and water
- Seeds can survive for many years
- Found (very rarely) in protected sanctuaries

Seabeach Amaranth

Grasses of the Interdune

Grasses are the dominant plants of the interdune

- American Beach Grass is the most prominent
- Three other grasses have a major presence:

Reed Grass - *Phragmites australis*

- A tall invasive exotic perennial – up to 12 ft.
- More commonly found in the marsh
- Dense growth crowds out other plants
- Propagates primarily via rhizomes
- Extremely difficult to eradicate

Bitter Panicgrass - *Panicum amarum*

- A tall native perennial
- Thick, bluish colored leaves – up to 8 ft.
- Grows in dense clumps
- Good sand binding abilities

Little Bluestem - *Schizachyrium scoparium*

- A short native perennial - grows in dense clumps
- Soft bluish-green colored leaves – 2-3 ft. tall
- Important plant for butterflies
- In fall 4-5 ft. tall flowering stalks with a light purple feathery seed head make it stand out

Phragmites

Panicgrass

Phragmites spike

Little Bluestem in early fall

Other Plants of the Interdune

Seaside Goldenrod - *Solidago sempervirens*

- A tall, leafy native perennial
- Bright yellow flowers in late summer/early fall
- Favorite of the monarch butterfly and other insects

Goldenrod

Monarch feeding on Goldenrod flowers

Beach Pea - *Lathyrus maritimus*

- Vine like, native perennial
- Waxy, green leaves and purple flowers
- Propagates primarily via rhizomes

Beach Pea

Winged Pigweed - *Cycloloma atriplicifolium*

- Naturalized – native to the western U.S.
- An annual with many branches
- When desiccated can become a tumbleweed

Winged Pigweed

Plants of the Back Dune

Bayberry - *Morella pensylvanica*

- Native deciduous perennial shrub
- Prominent plant on the back dune *(also found in the interdune)*
- Bluish gray berries attractive to some birds
- Leaves have a spicy scent when crushed
- Provides cover for dune inhabitants
- American colonists used the berries to make candles

Bayberry shrubs

Berries

Beach Rose (*aka Japanese Rose*) – *Rosa Rugosa*

- Naturalized exotic perennial from Asia
- First naturalized sightings in the Northeast in 1899
- Flowers have a very pleasant sweet scent
- Leaves are leathery
- Stems have many prickles
- Potentially an invasive species

Beach Rose on back dune

Beach Rose flower

Behind the Back Dune

- The landward side of the back dune is the area most protected from winds, ocean spray and flooding
- Many more species of plants, both big and small, can be found in this protected part of the beach
- Some of these plants are native to Lido Beach; many more are naturalized
- Parking lots, roads, cabanas and maintenance areas form most of the boundary of the beach and land
- Vegetation of these areas can vary greatly
  - Dense stands of conifers and bushes can be found in some areas
  - Other areas more closely resemble the bushes and grasses found in the interdune and back dune

Dense tree growth behind back dune

Sparse growth behind back dune next to parking lot

Beach Plants Recap

- Plants are an important component of the beach ecology, providing food and shelter, and dune building and stabilizing properties
- The beach and dunes encompass a variety of habitats (zones) reflecting their proximity to the ocean and dunes
- Beach plants have a variety of adaptations to withstand the harsh beach environment
- Grasses (esp. American Beach Grass) dominate the beach landscape
- A wide variety of other beach plants, both big and small, can be found

Most of the paths which lead to the beach pass through a dune system. These paths provide a great vantage from which to observe the variety of beach plants and habitats.

Look down to see the small plants growing along the path; across to take in the grasses. Watch for flowering plants and the insects which feed on them.

Lots to see. Keep an eye out.

Seaweeds

- Seaweed Structure, Basics and Uses
- Seaweed Guide
- Ulva and the Bay

Seaweed's Importance

- Seaweed is an important component of the shoreline ecology - *providing nutrients to the beach; and food and shelter for sea creatures*

- Seaweed has been harvested from the shoreline for many centuries - *for food, animal feed, fertilizer, iodine, calcium*
  - Commercial seaweed farming (*mariculture*) and mining have reduced the need for a shoreline harvest

- Seaweeds have many commercial uses
  - Source of agar and carrageenan - *used extensively in foods and cosmetics*
  - In filtration systems – *to extract and capture toxins from water*
  - Food for human consumption - *esp. in Japan and China*

Many commercial uses

Look for carrageenan in the list of ice cream ingredients

Consumed by humans

Seaweed Basics

- Seaweed is a general term - *refers to several species of macroscopic, multicellular, marine algae (a photosynthetic organism*)
  - Commonly considered a plant – *but technically seaweeds are in their own kingdom*
  - Three varieties – *green, red and brown*
  - Require saltwater and sunlight - *availability of sunlight limits how deep they can grow*
  - Nutrients absorbed directly from the surrounding seawater – *not through roots*
  - Adapted to withstand saltwater and water currents
  - Lack the internal systems to transport water that are found in terrestrial plants

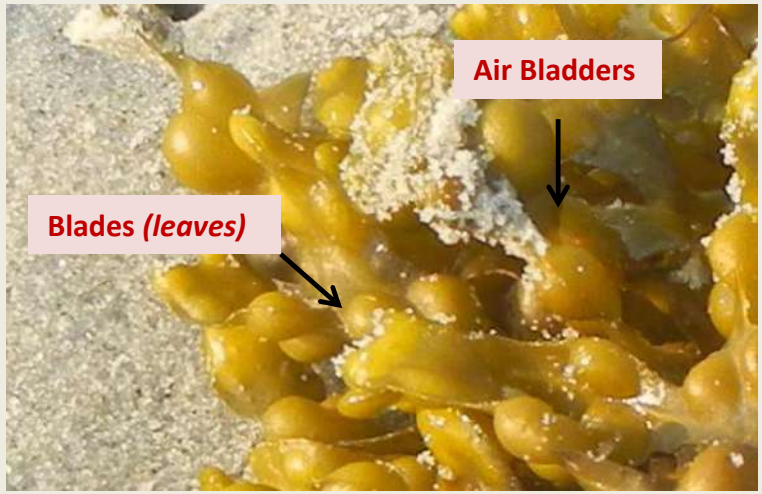
A red seaweed

A 'leafy' green seaweed

Seaweed Structure

- Seaweeds have features similar to terrestrial plants:
  - Holdfast – *means of attachment to a hard surface – e.g. rock, mussel shell*
  - Stipe – *like a stem in a terrestrial plant*
  - Branches
  - Blade – *like a leaf – important for photosynthesis, adsorption of nutrients*
- Seaweeds vary in the complexity of their structure
  - Simple seaweeds - *grow faster, softer, more easily grazed, easier to dislodge*
  - Complex seaweeds invest more in building structures - *more resistant to disturbance, more difficult for grazers, slower growing*
  - Some blades have air bladders to aid in keeping blade *(leaf)* floating - *maximizing nutrient adsorption and photosynthesis*

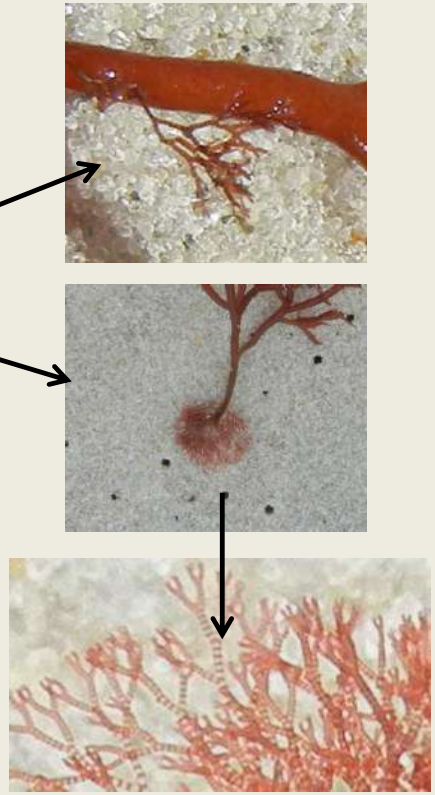
Basic structures of seaweed



Note air bladders

Epiphytic Seaweeds

- Epiphytes are non-parasitic plants or seaweeds that grow on other plants or seaweeds
  - Do not rob the host of nutrients
- Epiphytic seaweeds come in a variety of colors, shapes and sizes
  - Commonly found but may require close inspection to observe
  - 2 small banded red weeds growing on larger red seaweeds



Banded Red Weed magnified

Found with but not Seaweeds

- Eelgrass - a plant (not a seaweed) - can be found washed up on the beach and entangled with seaweeds - adapted for life in salt water
- Sea Squirts - an animal - can be found encrusted on seaweeds - worth a closer look - vibrant colors, spongy texture

Eelgrass on beach

Colonial Sea Squirts on seaweed

Seaweed Identification

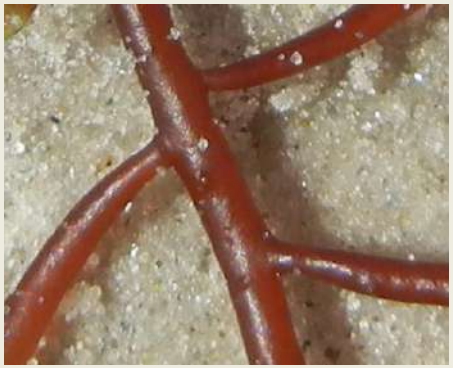
- There are many different species of seaweed that may be encountered on Lido Beach
  - For reference: Long Island Sound has approx. 250 species *(60-75 greens, 90-110 reds, 50-65 browns)*
- Many seaweeds look alike, making identification a challenge
  - A hand lens or microscope may be required to make some ID's
- Seaweeds found on the beach may be damaged or incomplete, complicating ID
- Color is not always an indicator to which group (green, red or brown) a seaweed belongs
  - For example, some red seaweeds may look black
  - Once detached, seaweed color can change
- Untangling a clump of seaweeds can reveal many individuals and types
  - Look for clumps freshly out of the ocean for the best specimens
  - Look for different colored seaweeds – red seaweeds will stand out

Red seaweeds stand out

A clump of seaweed can be untangled to reveal many individuals and types

Seaweed Identification – What to Look For

- Physical characteristics: Size, shape, color, branching characteristics, blade shape, stipe shape, shape of fruiting (reproductive) bodies, diameter of stipes and branches, and presence of air bladders are some clues to a seaweed's identity.
- Some examples of identifying characteristics:



Basally tapering branches

Flat branches and blades

Different diameter of branches

Fruiting bodies (dark bumps)

Shape of receptacles (contain reproductive bodies)

Branching characteristics

Seaweed Guide

- Examples of Red, Brown and Green Seaweeds
- Ulva and the Bay

Red Seaweeds

- Red Seaweeds can be found in abundance on the beach - usually in tangled masses
- Come in a variety of: colors - e.g. red, purple, black, greenish
  sizes – less than an inch to over 2 ft.
  shapes – sheets , densely or sparsely branched, flat or cylindrical branches
- Generally grow at lower depths in subtidal habitats
- Commercially important source of agar and carrageenan

Note: Seaweed identification can be difficult. Best efforts have been made to ensure the accuracy of the following ID's, but cannot be guaranteed.

Agardh's Red Weed
Agardhiella subulata

- Commonly found
- Thickish stipes and branches
- Coarsely branched
- Basally tapering round branches
- To 12"

Gracilaria sp.
(sp. connotes 'unspecified species')

- One of a few 'stringy' seaweeds commonly found (and confused)
- Branches thinner than Agardh's
- Important source of agar

Irish Moss
Chondrus crispus

- Flattened blades and branches
- Forked tips at end of blades
- Deeper red color, purplish
- Used to make blanc mange, a pudding
- Source of carrageenan, a thickener

More Red Seaweeds

- Red Seaweeds can take many similar looking forms
- One species can have different forms depending on its environment
- Some examples with best guesses of the common names - and others without ID's

Agardh's Red Weed - *(see different form on previous page*)

Graceful Red Weed

Brushy Red Weed

Three more forms of red seaweeds which may be found

Brown Seaweeds

- Brown seaweeds do not appear to be as abundant or as varied as the red seaweeds on our beach
- Prefer to grow in the mid intertidal zone (not as deep)
- Rockweeds (fucus genus) are the most commonly found
  - Blades are flat, wide and have a distinctive rib mid-blade
  - Shapes of receptacles (fruiting bodies at tip of blades) vary for each fucus species
  - Fucus vesiculosus (a.k.a. Poppers) have air bladders which provide amusement for children of all ages when popped

Rockweed, Poppers (*Fucus vesiculosus*)

Air bladders come in pairs

Rockweed (*Fucus distichus*)

Note: Rib mid-blade
Flat branches,
Absence of air bladders
Shape of receptacles

Knotted Wrack (*Ascophyllum nodosum*)

- Large (e.g. 2 ft.)
- Oval shaped air bladders in narrow ribless branches
- Many short branchlets
- Can live over a hundred years

Green Seaweeds

- Green seaweed can be found in abundance on the beach – *periodic inundations can carpet the beach*
- Prefer the upper intertidal zone (closer to the surface)
- Can be observed growing on the rock jetties at low tides - *can withstand being out of the water*
- Not many varieties observed – *more on Ulva, the most dominant genus, follows*

Dead Man's Fingers (*Codium fragile*)

- Fairly common
- Large (to 3 ft.)
- Thick spongy branches which float
- Not native to North Atlantic
- Pest to shellfish aquaculture

Green Pompoms (*Acrosiphonia arcta*)

- A tuft made up of many individual unbranched filaments
- Small, usually under 6"
- Filaments can twist together like rope

Green Sea Fern (*Bryopsis plumosa*)

- Delicate, bushy, light green
- Small, usually under 4"
- Look for other delicate green seaweeds at the jetties at low tide

Ulva

- Ulva lactuca – Sea Lettuce - the most abundant seaweed encountered on the beach
  - A simple bright green seaweed with no apparent stem-like structure (stipe)
  - Grows in flat, thin, soft, almost translucent sheets that are two cells thick
  - Fast growing - can thrive in moderately polluted waters like our bays
  - Easily detached by tidal currents
  - Ulva comes in many varieties
- Can be seen at low tide growing on jetty rocks or as detached sheets washed up on the shore face
  - Will quickly rot when trapped above the high tide line
- Most of the Ulva comes from the bay and drifts out through the inlet onto the beach
  - The jetties at Pt. Lookout can trap Ulva

Ulva species growing on rock jetty

Sea lettuce washed up on beach

Ulva and the Bay Park Sewage Treatment Plant (BP-STP)

- The BP-STP treats the sewage for over 500,000 Nassau County residents
  - Severely damaged during Hurricane Sandy – has since been repaired and fortified
  - **Over 50 million gallons of treated effluent are discharged every day into the bay**
  - The 84” discharge pipe is north of Long Beach near the Magnolia fishing pier
- The discharge has caused nitrogen levels to rise to an ecologically unhealthy level
  - The fast growing, nitrogen-loving Ulva population has exploded in the bay
  - Tidal currents detach the Ulva and move it through the inlet and onto the beach
  - When the Ulva blankets the beach it can readily decay
  - The rotting Ulva can give off noxious gases that smell and can be harmful to humans
  - Pt. Lookout is especially susceptible to these episodes

Beach near inlet inundated by Ulva

Unassuming BP-STP outflow from which over 50 million gallons of effluent flow daily into bay

Reducing Nitrogen in the Bay

The abundance of nitrogen-loving Ulva in the bay affects other plants and animals

- The large lettuce-like leaves rob other organisms of needed sunlight
- Decaying Ulva contributes to the depletion of oxygen (hypoxia)
    - Hypoxia can cause fish die-offs
    - Weakens the root structures of marsh grasses

Nassau County has proposed piping the BP-STP treated effluent to the Cedar Creek Wastewater Treatment Plant in Wantagh

- The Cedar Creek effluent outflow is 3 miles out in the ocean
- An existing 100+ year old abandoned aqueduct which parallels Sunrise Highway would be reconditioned
- Piping would be built between the aqueduct and the two sewage treatment plants
- Estimated cost is $360 million
- Would reduce nitrogen levels in the bay by over 90%
- The City of Long Beach may also use Cedar Creek, further reducing nitrogen in the bay

Newly fortified Bay Park Sewage Treatment Plant – with flood gates

Seaweeds Untangled – A Final Look

- Some more examples of ‘spaghetti like’ seaweeds that are commonly found
- These could be examples of seaweeds with names like: cord, whip, wire and hooked weed
- For reference, the footprint is 9 inches

Seaweed Recap

- Seaweeds are an important source of: food for sea creatures; nutrients for the beach; commercial products
- Red, brown and green seaweeds take many forms, and vary in their complexity
- They have structures (holdfast, stipe, branches and blades) which resemble terrestrial plant structures
- There are many varieties of seaweed; identification can be difficult; look for distinctive characteristics
- The overabundance of Sea Lettuce in the bay will be addressed by redirecting treated effluent to the ocean

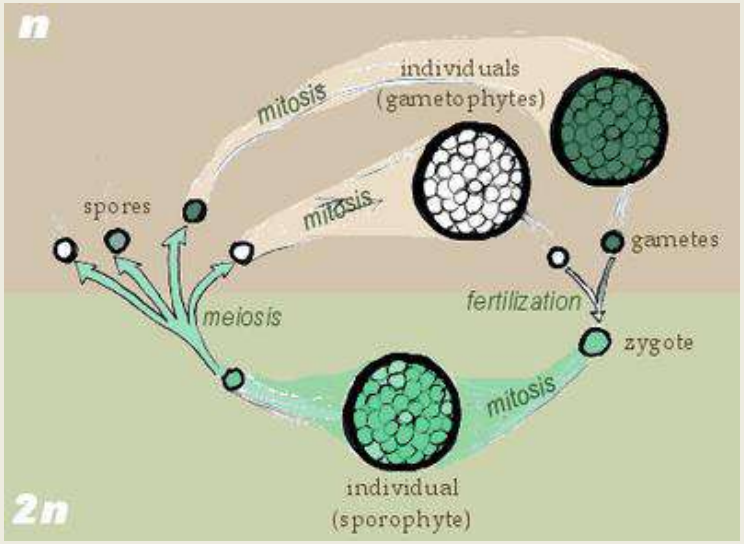
As you walk the beach, pick up a seaweed. Feel its texture. Note the color and branching pattern. Find the bottom of the specimen (holdfast) and lay it out (as in the pictures below) to get a sense of what it might look like growing in the bay or ocean.

A good time to find seaweeds is shortly after a high tide, when fresh specimens will have been deposited on the beach. Low tide at the jetties will reveal seaweeds growing on the rocks, as they sway in the wash.

Look down. And enjoy this oft overlooked, but interesting, slice of nature.

Plant and Seaweed Reproduction

- Most plants and seaweeds employ an "alternation of generation" strategy for reproduction
  - A mature plant *(sporophyte – 2nd generation diploid)* produces male and female spores *(through meiosis)* each with a single set of chromosomes
  - The spores grow by cell division *(mitosis)* into male and female gametophytes *(1st generation – haploids)* - *In flowering plants these are the stamen and pistil*
  - The gametophytes produce male or female gametes (*egg or sperm*) which fuse *(e.g. through pollination)* to create a zygote *(fertilized egg) – Insects , birds and wind are the main pollinators*
  - The zygote grows through cell division *(mitosis)* into a new mature plant *(sporophyte - diploid)*
  - The gametophytes can develop within the sporophyte *(e.g. flowers)* or outside the sporophyte *(seaweeds)*



Plant and Seaweed Reproduction *(cont'd)*

- Most plants *(monoecious)* produce both male and female gametes
  - Generally these develop on the plant *(e.g. in the flower)* and are dependent on the plant for nourishment

- Some plants are either male or female (*dioecious)* - producing either male *(pistils)* or female *(stamens)* gametophytes
  - These require the presence of a plant of the opposite 'sex' to achieve pollination

- Animals require only a single generation to reproduce - *directly producing eggs or sperm without first producing gametophytes*

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Stewart Van Patten, Margaret "Peg" and Yarish, Dr. Charles, "Bulletin No. 39: Seaweeds of Long Island Sound" (2009). *Bulletins.* Paper 40. - http://digitalcommons.conncoll.edu/arbbulletins/40 (Link to downloadable PDF of this excellent guide to local seaweeds)

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Photographs

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