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**Household Pests**

All homes occasionally run into problems with household pests. While most are merely a nuisance, some may bite, sting or transmit disease. A few may even cause serious structural damage which can impact the value of your house.

**[](https://www.callnorthwest.com/wp-content/uploads/2013/11/PicMonkey-Collage.jpg)Pests that threaten our health:**

* [Cockroaches](https://www.callnorthwest.com/learning-center/identify-your-pest/roaches/)
* [Rodents](https://www.callnorthwest.com/learning-center/identify-your-pest/rodents/)
* [Ticks](https://www.callnorthwest.com/learning-center/identify-your-pest/ticks/)
* [Mosquitoes](https://www.callnorthwest.com/learning-center/identify-your-pest/mosquitoes/)
* Stinging Insects
* [Spiders](https://www.callnorthwest.com/learning-center/identify-your-pest/spiders/)
* [Bed Bugs](https://www.callnorthwest.com/learning-center/identify-your-pest/bed-bugs/)

**Controlling Pests:**

* Clean
* De-Clutter
* Seal cracks and crevices
* Screen vents and gaps
* Doors and windows tightly sealed and closed
* No standing water
* No leaky faucets
* Clean yard and gutters from debris
* Hire a [professional pest management company](https://www.callnorthwest.com/2013/11/household-pest/www.callnorthwest.com) to regularly treat your property and identify areas of concern

**Common household pest**

1. **Ants**

Ants are important natural predators of many insect pests including flea and fly larvae, caterpillars and termites. Ants range in size from about 1/32 to 3/4 inch long. They have three body parts (head, thorax and abdomen) and can be anywhere from a yellowish-red in color to black. Most are wingless, but winged forms exist during “swarming” or colony reproduction. Ants have pincer-like jaws and can bite although most do not. A few species are very aggressive and will inflict a painful sting.

### Life Cycle

Ants are social insects and live in colonies with three distinct types of adults called castes. Queens are larger than their peers and are responsible for egg laying. Some species have only one queen per colony whereas others have many. Males are responsible for mating with the queens; they do not participate in any other activities. Workers are sterile wingless females. They make up the bulk of the colony and are responsible for building and defending the nest, caring for the young and foraging for food.

### How to Control

Like all pests, ants require food and water to survive; by eliminating these basic necessities you can greatly reduce their numbers.

1. Store food and organic wastes in sealed containers, clean up all kitchen surfaces and empty trash daily.
2. [Diatomaceous earth](https://www.planetnatural.com/product/ant-crawling-insect-killer-de/) contains no toxic poisons and works quickly on contact. Dust lightly and evenly around areas where pest insects are found.
3. **Cockroaches**

There are more than 3,500 known roach species found throughout the world, many of which infest home kitchens, restaurants, hotels and grocery stores. Cockroaches consume human foodstuffs and contaminate them with saliva and excrement. They are responsible for transmitting diseases such as the bacteria which cause food poisoning and are a significant source of allergies indoors, second only to house dust.

**Identification**

Adult house-infesting cockroaches are medium to large insects (1/2 – 2 inches long, depending on species) that vary in color from a light reddish brown to black. They have a broad, flattened shape, spiny legs and long, whip-like antennae. Roaches are active at night and will scatter quickly when disturbed by light. Immature stages (nymphs) resemble adults, but are smaller and have undeveloped wings. The cockroach evolved as a scavenger of decaying plant materials; as a result, it prefers carbohydrates to protein and fat.

### Life Cycle

Adult female roaches produce egg capsules, which may contain up to 50 eggs. Some species carry them on their bodies until hatching takes place, while other drop the capsules in protected places that they frequent. After about 30 days young nymphs appear and begin their gradual development. As with all insects, roaches must shed their outer skin, or molt, to grow. Immediately after molting, they are white, but within hours their body becomes dark and hardens. Depending on the species, it may take a single cockroach as little as six weeks to become an adult or as long as a few years. There are several generations per year.

### How to Control

1. Cockroach populations flourish where food and moisture are readily available. As a result, sanitation is an important step in prevention and management. Reduce the carrying capacity of your home by **placing food and waste in sealed containers.**
2. **Reduce pest hiding places,** like cracks and crevices, with caulk and paint.
3. **Fly**

The common house fly (Musca domestica) multiplies rapidly and is one of the most prevalent of all insect pests. It has been associated with over 100 different disease pathogens, including salmonella, cholera and tuberculosis, so it is important to manage pest outbreaks.

When feeding, house flies regurgitate liquid from the stomach to dissolve food, and then use their sponging mouthparts to suck it up. They leave fecal spots, or “specks,” where they have walked, and in this way may transfer disease organisms to humans and animals. In rural areas, flies can be a nuisance when they gather on the outside walls of homes and buildings on summer evenings.

### Identification

House flies (1/6 – 1/4 inch long) are dull gray in color with reddish-brown eyes. They have two membranous wings and four dark stripes down the middle section of their body (thorax). Females are usually larger than males and can be distinguished by the space between their eyes, which is almost twice the distance as in males. The larval stage (3/8 – 3/4 inch), also known as a maggot, is soft, cream-colored and worm-like. They are typically found around rotting organic matter, such as manure piles of garbage cans and are somewhat carrot shaped.

### Life Cycle

An adult female housefly will deposit several egg masses, each containing up to 130 white eggs in manure or fermenting vegetation such as grass clippings and garbage. Hatching takes place in 10-24 hours; the young maggots become fully grown in 3-7 days, crawl to the margins of the breeding material and pupate. The pupal stage may vary in length considerably, but in warm weather can be about three days. When adults emerge they begin mating immediately. An entire life cycle; egg, larva, pupa to winged adult may occur in 6-10 days under warm, moist conditions. Adults may live an average of 30 days. During warm weather 2 or more generations may be produced per month.

### How to Control

1. Sanitation is the most effective and important step in reducing pest numbers.
2. Dry and wrap organic waste before placing it in the garbage can.
3. Seal garbage cans with tight fitting lids.
4. Screen windows and doors to keep flying pests out.
5. **SPIDERS**

Some 30,000 species of spiders occur throughout the world. They have eight legs and two body segments. For the most part, they are [considered to be beneficial](https://www.planetnatural.com/garden-spiders/) because they feed primarily on insects and other spiders. At times they become a nuisance by finding their way inside your house. This typically occurs in the early fall when cooler temperatures force them to seek shelter.

Almost all spiders are harmless and usually remain hidden. They do not seek out and bite humans. In fact, most cannot penetrate our skin with their fangs. A few are considered venomous to humans and care must be taken to avoid being bitten.

### Life Cycle

The life-cycle varies greatly depending upon species. In most cases, females reproduce by laying eggs in a silken egg sac. The egg sac is either carried around or hidden in the web. Tiny, newly hatched spiders emerge 2-3 weeks later. Most mature to adults in about one year. Several species live 1-2 seasons, but the females of a few species may live 5-20 years. Males and females live separately and only come together to mate.

### How to Control

1. Keep boxes, old equipment and other items neatly stored on shelves, particularly in garages and basements.
2. Clean up and dispose of trash, debris, old equipment, etc.
3. Repair screens and maintain the weather-stripping around doors and windows

**Apiculture**

**Different types of bees**

There are several hundred different types of bee but we discuss about two different groups: social bees and solitary bees. Other insects like hoverflies, hornet moths and clearwing moths, mimic the colors of bees so they don't get eaten.

1. **Social bees**

As their name suggests, social bees live in groups. **Honeybees** are particularly sociable and can live in groups of up to 50,000 together in a single hive. **Bumblebees** are also social, but live in smaller groups of 50-150. Both types depend on queen bees who lay all of the eggs for the group. Social bees are a common sight in our gardens.

1. **Common carder bee (*Bombus pascuorum***)

The Common carder bee is a fluffy, gingery bumble bee that can often be found in gardens and woods, and on farmland and heaths. It is a social bee, nesting in cavities, old birds' nests and mossy lawns.

1. **Honey Bee** ***(Apis mellifera)***

The black-and-gold Honey Bee is well-known as a hive bee: semi-domesticated for thousands of years to produce honey for human consumption. It is also an important pollinator of flowers and crops**.**

1. **Solitary bees**

In contrast, solitary bees live on their own. They can make burrows underground, or live in quarry faces, old wood, and even masonry. A female solitary bee builds her nest and provides food for her young without the help of any worker bees. Despite this some solitary bees may appear to live in colonies, with many bees making their nests close to each other in a suitable piece of habitat. There are over 250 kinds of solitary bee.

**TYPES OF SOLITARY BEES**

1. **Red Mason Bee (*Osmia bicornis)***

The Red Mason Bee is a common, gingery bee that can be spotted nesting in the crumbling mortar of old walls. Encourage bees to nest in your garden by putting out a tin can full of short, hollow canes.

1. **Tawny mining bee(** ***Andrena fulva)***

The Tawny mining bee is a furry, gingery bee that can often be seen in parks and gardens during the springtime. Look for a volcano-like mound of earth in the lawn that marks the entrance to its burrow.

1. **Hairy-footed flower bee(*Anthophora plumipes)***

The hairy-footed flower bee can be seen in gardens and parks in spring and summer, visiting tubular flowers like red dead-nettle and comfrey. As its name suggests, it has long, orange hairs on its middle legs.

**Colonial organization of bees**

**Introduction**

Honey bees are social insects, which mean that they live together in large, well-organized family groups. Social insects are highly evolved insects that engage in a variety of complex tasks not practiced by the multitude of solitary insects. Communication, complex nest construction, environmental control, defense, and division of the labor are just some of the behaviors that honey bees have developed to exist successfully in social colonies. These fascinating behaviors make social insects in general, and honey bees in particular, among the most fascinating creatures on earth.

**Kinds of bees in a colony**

A honey bee colony typically consists of three kinds of adult bees: workers, drones, and a queen. Several thousand worker bees cooperate in nest building, food collection, and brood rearing. Each member has a definite task to perform, related to its adult age. But surviving and reproducing take the combined efforts of the entire colony. Individual bees (workers, drones, and queens) cannot survive without the support of the colony.

1. **Queen**

Each colony has only one queen generally except specific conditions. Because she is the only sexually developed female, her primary function is reproduction. She produces both fertilized and unfertilized eggs. Queens lay the greatest number of eggs in the spring and early summer. During peak production, queens may lay up to 1,500 eggs per day. One queen may produce up to 250,000 eggs per year and possibly more than a million in her lifetime.

A queen is easily distinguished from other members of the colony. Her body is normally much longer than either the drone’s or worker’s, especially during the egg-laying period when her abdomen is greatly elongated. Her wings cover only about two-thirds of the abdomen, whereas the wings of both workers and drones nearly reach the tip of the abdomen when folded. The queen can live for several years—sometimes for as long as 5, but average productive life span is 2 to 3 years.

1. **Drones**

Drones (male bees) are the largest bees in the colony. They are generally present only during late spring and summer. The drone’s head is much larger than that of either the queen or worker.Drones has no stinger, pollen baskets, or wax glands. Their main function is to fertilize the virgin queen during her mating flight. Although drones perform no useful work.

While drones normally rely on workers for food, they can feed themselves within the hive after they are 4 days old. Since drones eat three times as much food as workers, an excessive number of drones may place an added stress on the colony’s food supply. Drones stay in the hive until they are about 8 days old, after which they begin to take orientation flights. Flight from the hive normally occurs between noon and 4:00 p.m. Drones have never been observed taking food from flowers.

1. **Workers bees**

Workers are the smallest and constitute the majority of bees occupying the colony. They are sexually undeveloped females and under normal hive conditions do not lay eggs. Workers have specialized structures, such as brood food glands, scent glands, wax glands, and pollen baskets, which allow them to perform all the labors of the hive. They clean and polish the cells, feed the brood, care for the queen, remove debris, handle incoming nectar, build beeswax combs, guard the entrance, and air-condition and ventilate the hive during their initial few weeks as adults. Later as field bees they forage for nectar, pollen, water, and propolis (plant sap).

The life span of the worker during summer is about 6 weeks. Workers reared in the fall may live as long as 6 months, allowing the colony to survive the winter and assisting in the rearing of new generations in the spring before they die.

# Division of labor in honey bees

# Honey bees are social insects, which mean that they live together in large, well-organized family groups.

|  |  |  |
| --- | --- | --- |
| **S.N.** | **Type and Age** | **Functions/ Duties** |
| 1. | The queen bee | -To lay eggs  -To control and guide the colony by releasing              pheromone (special odor) |
| 2. | Drone | - To fertilize the queen |
| 3. | Worker (1-3 days old) | -To give warmth to eggs, larva and pupae  - To  clean the cells |
| 4. | Worker (4-6 days old) | - To feed older larvae with honey and pollen |
| 5. | Worker (7-11 days old) | - To feed royal jelly produced from their nurse glands to the queen and younger larvae (below 3 days) |
| 6. | Worker (12-17 days old) | -To produce wax and build a honey comb  -To seal  the cells of the larvae and honey |
| 7. | Worker (18-20 days old) | -To protect the bee hive from enemies and                   ventilate the hive |
| 8. | Worker (21 days onwards) | -To collect nectar, pollen, propolis and water |

**Division of Labor in Wasps**

**Types of Division of labor**

These are of 2 types:

* Reproductive division of labor
* Non-reproductive division of labor

1. **Reproductive Division of Labor**

The reproductive division of labour determines who becomes the queen and reproduces, and who becomes the worker and carries out tasks other than reproduction. When more than two workers are present in a nest, an additional division of labour emerges that determines who does the housekeeping job and who does work outside the nest.

1. **Non-Reproductive Division Of Labor**

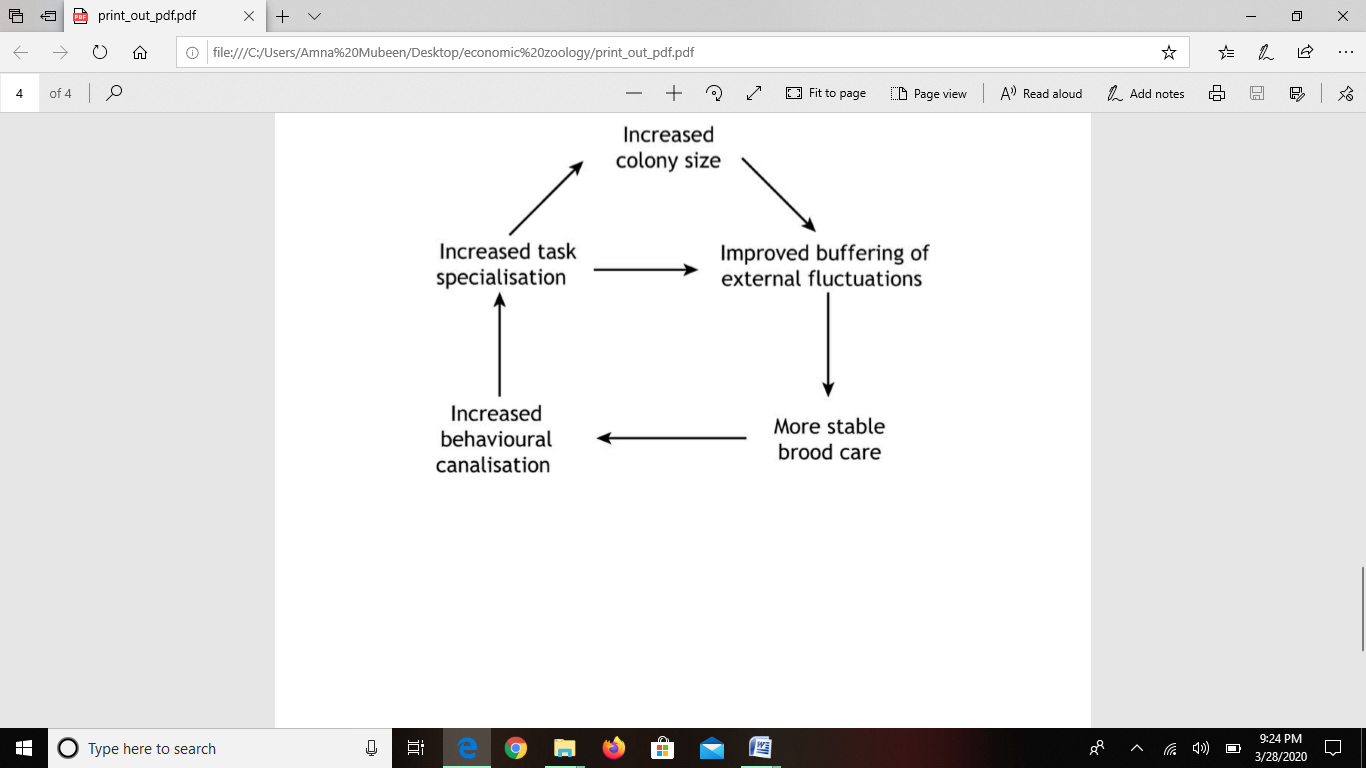
The non-reproductive division of labour among workers emerged only when three wasps are present.

**Physical aggression**

Physical aggression such as biting, pecking, nibbling and chasing helps in determining the dominant and subordinate distinction among the individuals. In the case of pairs, the dominant individual became the queen and the subordinate became the worker. With triplets, the most dominant becomes the queen, and the most dominant wasp among the workers built the nest, did the housekeeping and feeds the larvae while the least aggressive wasp fetched food, water, and building material for the nest.

**Increasing productivity**

Cooperation and reproductive division of labour as seen in pairs are inadequate for increasing productivity. Compared with pairs, triplets are able to produce more offspring, they have more productivity. For cooperation to emerge just two individuals are sufficient. The worker wasp does not sulk or both don’t build their own nests. Instead, the worker helps the queen to build the nest, feed the brood and maintain the nest — that’s cooperation.

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**Enemies of bees**

**Introduction**

The most important enemies are those that destroy the combs, the stores, the hive itself and some predators that take foraging worker bees as they leave the hive, or those that behave as true parasites by raising their offspring in the of bees. The enemies of bees can be classified as parasites, predators, disturbers, or commensals depending on the nature of their damage and their interdependence with bees.

**1.** **Arthropods: Arachnids**

**A) Spiders**

The most damaging enemies of bees amongst the spiders are the "orb weavers" which may become particularly numerous in years of drought. The "crab spiders" are also fearsome enemies of bees. They do not spin webs to capture their prey but lie in wait on or near flowers.

**2. Arthropods: Insects**

**A) The greater wax moth, Galleria mellonella**

It destroys a large number of combs every year, attack the wax foundation and can reduce stored combs and weak colonies to a pile of debris. Wax moths only cause considerable damage in apiaries if the colonies they attack are incapable of repelling them. Wax moths may also be implicated in the spread of contagious diseases, especially foulbrood, by consuming contaminated combs.

**C) Other Lepidoptera**

Apart from the greater and lesser wax moths, various other moths can be found inside hives such as the "deathhead moth" Acherontia atropos, a notorious enemy of bees in many countries.

**D) Coleoptera**

Some Coleoptera cause moderate damage to colonies but most are occasional visitors to hives and feed on pollen and on debris. In general, Coleoptera are found at the bottom of weak colonies and in stored combs.

**E) Hymenoptera**

The order Hymenoptera comprises the bees, ants and wasps. The most dangerous predators of bees belong to the family Vespidae (wasps and hornets) and the family Sphegidae (Philanthus apivorous). In some years the "wasps" have no hesitation in entering weak hives and taking the honey.

**3. Amphibians**

Different species of toads feed on bees whilst the frogs may swallow one occasionally. However, both are useful animals as they help to limit the population growth of molluscs, worms and parasitic insects. If they become a nuisance to colonies it is easy to protect them by raising them off the ground.

**4. Birds**

In temperate areas, several species occasionally catch bees in flight, some species may disturb the bee colony. The tits, and especially the great tit, Parus major, capture bees to feed their young, but do little harm to strong colonies. However, during periods of scarcity in the winter, they may persistently tap on the hives to catch the worker bees drawn to the entrance.

**5. Mammals**

**Mice**

Mice are known everywhere as a nuisance to bee colonies. The main species, the domestic mouse (Mus musculus) and the wood mouse (Apodemus sylvaticus), can enter hives and destroy stored apicultural equipment. The mice feed on pollen, honey and on bees. Their attacks can result in the loss of a whole colony or in its exhaustion. The mice create space for their nests by gnawing at the combs. The mice create even more of a nuisance through the smell of their urine and excrement which may cause the bees to desert the hive in the spring.

**Other mammals**

Amongst the carnivorous mammals the jackal, the raccoon and some weasels are occasional enemies of bees. In Africa and Asia the nocturnal honey badger is harmful to bees because it is capable of knocking heavy colonies off their stands and carrying off combs. The bear is probably the largest animal harmful to bees. The black bear of North America probably causes the most significant problems, but the brown bear of Europe and three other Asian species are also notorious pests in apiaries.

**Sericulture**

**Sericulture**, also called silk farming, is the process of making silk fibers. It starts by raising silkworms and then processing the fibers they produce.

**What is Silk?**

Silk - the most beautiful of all textile fibers is acclaimed as the queen of textiles. It comes from the cocoon of the silk worm and requires a great deal of handling and processing, which makes it one of the most expensive fibers also. Today China is the leading silk producer of the world. Other major silk producing countries include Japan, India and Italy.

**Silkworm**

Basically silkworm is the commercially bred caterpillar of the domesticated silk moth ( *Bombyx mori* ), which spins a silk cocoon that is processed to yield silk fibre.

The species Bombyx mori is usually cultivated and is raised under controlled condition of environment and nutrition.

## The Life Cycle of Silkworm:

## Life Cycle of Silkworm

### ****Stage 1: Egg****

An egg is the first stage of the life cycle of silkworm. The egg is laid by a female moth which is mostly the size of small dots. A female moth lays more than 350 eggs at a time. In the springtime, the eggs hatch due to the warmth in the air. This procedure happens once in every year.

### ****Stage 2: Silkworm****

A hairy silkworm arises after the eggs crack. In this stage of silkworms, the growth happens. They feed on mulberry leaves and consume a large amount of these leaves for around 30 days before going to the next stage.

### ****Stage 3: Cocoon****

In this stage, it swings its head, spinning a fiber made of a protein and becomes a silk fiber. By these fibers they form a protective cocoon around itself. It is the size of a small cotton ball and is made of a single thread of silk.

### ****Stage 4: Pupa****

Pupa stage is a motionless stage. In this stage, the pupa protects itself inside the cocoon and stays dormant.

### ****Stage 5: Moth****

In this stage, the pupa changes into an adult moth if cocoon survived. The moth with fully developed wings emerges out of the cocoon. The female moth lays eggs after mating and thus the life cycle of silkworm begins again.

**The Silk Production**

1. **Production of Cocoon:**

The silk moth is kept in controlled environmental conditions. The moth lays thousands of eggs. The silk moth’s eggs hatch to form larvae or caterpillars, known as **silkworms**. The larvae feed on [mulberry](https://simple.wikipedia.org/wiki/Mulberry) leaves.

After having grown and moulted several times, the silkworm pushes out silk fibers to make a net to hold itself. It swings its head from side to side in a figure '8' distributing the [saliva](https://simple.wikipedia.org/wiki/Saliva) that will form silk. The silk solidifies when it contacts the air. Thus they form a cocoon in which the silkworm encloses itself in about two or three days.

The silkworm spins approximately one mile of filament to complete a cocoon

* The amount of usable quality silk in each cocoon is small. As a result, about 2,500 silkworms are required to produce a pound of raw silk.

1. **Recovery of Cocoon:**

Two methods are well known for recovering the cocoon of silkworm. They are as follows:

1. The cocoons obtained from silkworms are then **boiled**, killing the silkworm pupa inside it. The silk filaments are obtained by brushing the undamaged cocoon to find the outside end of the filament. The silk filaments are then wound on a reel.

One cocoon contains approximately 1,000 yards of silk filament. The silk at this stage is known as raw silk. One thread comprises up to 48 individual silk filaments.

1. **Filature** **operations**:

The cocoons raised by the farmer are delivered to the factory, called a filature, where the silk is unwound from the cocoons and the strands are collected into skeins.

The filature operations consist of the following stages:

1. **Sorting cocoons:**

The cocoons are sorted according to the color, size, shape and texture as these affect the final quality of the silk. Cocoons may range from white and yellow to grayish.

1. **Softening the Sericin :**

Silk filament is a double strand of fibroin protein, which is held together by a gummy substance called **sericin** or silk gum. After the cocoon has been sorted, they are put through a series of hot and cold immersions, as the sericin must be softened to permit the unwinding of the filament as one continuous thread.

1. **Reeling the filament:**

Reeling is the process of unwinding the silk filaments from the cocoon and combining them together to make a thread of raw silk. Three to ten strands of silk filaments are usually reeled at a time to produce the desired diameter of raw silk which is known as "reeled silk". The usable length of reeled filament is 300 to 600 m.

1. **Bailing :**

The silk filament is reeled into skeins, which are packed in small bundles called books, weighting 2 to 4.5 kg. These books are put into bales weighing about 60 kg. In this form raw silk is shipped to silk mills all over the world.

**Types of Silk & Their Uses**

1. **Mulberry Silk**

Mulberry silk is the most common and widely used silk around the world. It accounts for about 90% of the world’s supply. The bulk of silk produced around the world comes from the mulberry variety. Thus, the term generally refers to the silk from a mulberry worm. This type of silk is produced by the Bombyx mori silkworm who feed on mulberry bushes. The disadvantage of using mulberry silk is that it requires extra care to maintain its smooth texture.

1. **Tasar Silk**

**Tasar** or **tussah** silk is a type of wild silk produced by caterpillars of Tasar silkworm. The Japanese Tasar silkworm produces a green silk thread. Most of the tasar silk are mainly used in furnishing and interior since they are the **strongest fibers** in the world. The silk is available in its natural form since it is tough to dye.

1. **Eri Silk**

Eri silk, also known as the Endi or Errandi silk, is a creamy white-colored silk. It is derived from two domesticated species of silkworms known as **Samia** **ricini** and **Philosamia** **ricin**. The silk has a mat appearance of wool or cotton. Eri silk is durable and makes great material for clothing and soft furnishing such as curtains.

1. **Muga Silk**

Muga silk is golden yellow in color. The Muga silkworm also belongs to the same genus as the Tasar silkworm. The silkworm is semi-domesticated, especially in Assam and feeds on aromatic leaves of soalu plants. The silk is limited in supply and is only used in the state of Assam for making traditional dresses, especially for the royal families. Mass production of muga silk is possible since the silkworm does not require delicate care.

1. **Mussel Silk**

It is often called the ‘sea silk’ since it is produced by mussels found on the seabed. The brown filament is produced by the mussel to anchor it to rock. The filament is combed and spun into a silk referred to as fish silk. The production of mussel silk is confined to the shores of Taranto, Italy. It accounts for one of the most expensive types of silk.

1. **Anaphe Silk**

Anaphe silk is commonly produced in the southern and central African countries. It is produced from a silkworm in the genus **Anaphe**. The fluff is spun into a raw silk that is normally soft and lustrous. The fabric made out of Anaphe silk is elastic and stronger than the mulberry silk. The silk is used in making velvet, light seat covers, and plush.

**Aquaculture & Fisheries in Pakistan**

**What is Aquaculture?**

Aquaculture is the process of rearing, breading and harvesting of aquatic species, both animals and plants, in controlled aquatic environments like the oceans, lakes, rivers, ponds and streams. It serves different purposes including; food production, restoration of threatened and [endangered species populations](https://www.conserve-energy-future.com/most-endangered-species-on-earth.php), wild stock population enhancement, building of aquariums, and fish cultures and [habitat restoration](https://www.conserve-energy-future.com/causes-effects-solutions-for-habitat-loss-and-destruction.php).



**History of Fish Culture in Pakistan:**

Freshwater **fish culture** in earthen ponds, both small and large reservoirs as well as community ponds was initiated in late 1960s by the provincial fisheries departments. From 1980 onwards the polyculture of Indian major carps and Chinese carps has been carried out in Punjab, Sindh and to some extent in NWFP.

**Aquaculture Resources of Pakistan:**

Pakistan has many marine and inland fishery resources. The potential was estimated at 1 million tones / year from the marine subsector alone. The commercially important resources include near 250 [demersal fish](https://en.wikipedia.org/wiki/Demersal_fish" \o "Demersal fish) species, 50 small [pelagic fish](https://en.wikipedia.org/wiki/Pelagic_fish) species, 15 medium-sized pelagic species and 20 large pelagic fish species. In addition, there are also 15 commercial species of [shrimp](https://en.wikipedia.org/wiki/Shrimp), 12 of [cephalopods](https://en.wikipedia.org/wiki/Cephalopod) and 5 of [lobster](https://en.wikipedia.org/wiki/Lobster)

* **Marine varieties:**

The shrimp variety includes the species of [Penaeus indicus](https://en.wikipedia.org/wiki/Penaeus_indicus" \o "Penaeus indicus) and [Penaeus monodon](https://en.wikipedia.org/wiki/Penaeus_monodon" \o "Penaeus monodon) among 12 other. Surveys in the [Arabian Sea](https://en.wikipedia.org/wiki/Arabian_Sea) indicate that commercial species of crustaceans like shrimps and lobsters are [overexploited](https://en.wikipedia.org/wiki/Overexploited). Crabs, cephalopods and other molluscs are an unconventional resource. However, there is a potential in the export market as a substitute for these. These resources are prime candidates for conversion to fishmeal for use in poultry and aquaculture but no commercial use is available in the country. Mussels, oysters, clams, seaweed, kelp, sea urchins and other marine resources also exist in Pakistan but further research data is required in order to evaluate the feasibility of propagating the mariculture of these varieties.

The major fish harbors of Pakistan are:

* [Karachi Fish Harbor](https://en.wikipedia.org/wiki/Karachi_Fish_Harbour) handles about 90% of fish and seafood catch in Pakistan and 95% of fish and seafood exports from Pakistan.
* [Karachi Fisheries Harbor](https://en.wikipedia.org/wiki/Karachi_Fisheries_Harbour) is being operated by Provincial Government of Sindh.
* [Korangi Fish Harbor](https://en.wikipedia.org/wiki/Korangi_Fish_Harbour) is being managed by Federal Ministry of Ports & Shipping.
* [Pasni Fish Harbor](https://en.wikipedia.org/wiki/Pasni_Fish_Harbour) being operated by Provincial Government of Balochistan.
* [Gwadar Fish Harbor](https://en.wikipedia.org/wiki/Gwadar_Fish_Harbour) being operated by Federal Ministry of Communication.

**Culturable Species of Fishes:**

1. **Labeo rohita (rohu)**

**Geographical distribution**

This fish is commonly found in Pakistan, India, Nepal, Bangladesh, Burma, and Thailand, china, Kampuchea and Sri lanka.

1. **Catla catla (thalia)**

**Geographical distribution**

This fish is commonly found in Pakistan, India, Nepal, Bangladesh, Burma, and Thailand, china, Kampuchea and Sri lanka

1. **Silver carp (*Hypophthalmicthys molitrix*)**

**Geographical distribution**

It is native of south, central and northern China and Russia, transplanted in Europe south Asia, south East Asia and Africa.

#### Methods of Aquaculture

1. **Shrimp fishery**

The [shrimp](https://en.wikipedia.org/wiki/Shrimp) fishery is very meaningful because of foreign exchange earned and employment produced from it. It is only permitted in province of Sindh. Commercial shrimp trawling started in 1958, after the [MFD](https://en.wikipedia.org/wiki/Marine_Fisheries_Department) introduced mechanization of larger fishing vessels. Now almost all of the shrimp [trawlers](https://en.wikipedia.org/wiki/Fishing_trawler) are equipped with winches for net hauling. However, shrimp can also be caught by the use of [cast net](https://en.wikipedia.org/wiki/Cast_net), which is locally termed 'thukri'.

1. **Tuna fishery**

The fishing of [tuna](https://en.wikipedia.org/wiki/Tuna) varieties is another appreciable aspect of the industry that is carried out by [artisanal fishing](https://en.wikipedia.org/wiki/Artisan_fishing) vessels. The main target is the pelagic species with higher commercial values. The catch is exported as chilled to neighboring country of [Iran](https://en.wikipedia.org/wiki/Iran) through informal channels for canning purposes.

1. **Benthic fishery**

The deep sea resources remain comparatively unexploited because local vessels are neither suitable nor equipped for deep-water fishery. The idea has motivated entrepreneurs to augment their deep-sea fishing craft for use of the resources.

1. **Pelagic fishery**

A small-scale [pelagic fishery](https://en.wikipedia.org/wiki/Pelagic_fish) is in operation in Sindh, using special nets, locally termed 'katra'. Fishing is carried out from 'hora' boats - wooden sailboats with pointed ends, a broad breadth and long-shaft outboard engine.

**Types of Aquaculture**

### 1. Mariculture

Mariculture is aquaculture that involves the use of sea water. It can either be done next to an ocean, with a sectioned off part of the ocean or in ponds separate from the ocean, but containing sea water all the same. The organisms bred here range from molluscs to sea food options like prawn and other shellfish, and even seaweed.

### 2. Fish farming

Fish farming is the most common type of aquaculture. It involves the selective breeding of fish, either in fresh water or sea water, with the purpose of producing a food source for consumption. [Fish farming](https://www.conserve-energy-future.com/causes-effects-solutions-of-overfishing.php) is highly exploited as it allows for the production of cheap source of protein.

1. **Intergrated multitrophic aquaculture**

IMTA is an advanced system of aquaculture where different trophic levels are mixed into the system to provide different nutritional needs for each other. Notably, it is an efficient system because it tries to emulate the ecological system that exists in the natural habitat.

**Economic Benefits of Pakistan**

### 1. Alternative food source

Fish and other seafood are good sources of protein. They also have more nutritional value like the addition of natural oils into the diet such as omega 3 fatty acids. Also since it offers white meat, it is better for the blood in reducing cholesterol levels as opposed to beef’s red meat. Fish is also easier to keep compared to other meat producing animals as they are able to convert more feed into protein. Therefore, its overall conversion of pound of food to pound of protein makes it cheaper to rear fish as they use the food more efficiently.

### 2. Alternative fuel source

Algae are slowly being developed into alternative fuel sources by having them produce fuels that can replace the contemporary [fossil fuels](https://www.conserve-energy-future.com/pros-and-cons-of-fossil-fuels.php). Algae produce lipids that if harvested can be burn as an alternative fuel source whose only by products would be water when burnt.

Such a breakthrough could ease the dependency of the world on drilled fossil fuels as well as reduce the price of energy by having it grown instead of drilling petroleum. Moreover, algae fuel is cleaner and farmable source of energy, which means it, can revolutionize the energy sector and create a more stable economy that avoids the boom-bust nature of oil and replaces it with a more abundant fuel source.

### 3. Increase Jobs in the market

Aquaculture increases the number of possible jobs in the market as it provides both new products for a market and creates job opportunities because of the labor required to maintain the pools and harvest the organisms grown. The increase in jobs is mostly realized in third world countries as aquaculture provides both a food source and an extra source of income to supplement those who live in these regions.

**Poultry industry**

Poultry farming is the form of animal husbandry which raises domesticated birds such as chickens, ducks, turkeys and geese to produce meat or eggs for food. Poultry – mostly chickens – are farmed in great numbers. More than 60 billion chickens are killed for consumption annually. Chickens raised for eggs are known as layers, while chickens raised for meat are called **broilers**. In the United States, the national organization overseeing poultry production is the Food and Drug Administration (FDA). In the UK, the national organization is the Department for Environment, Food and Rural Affairs (Defra).

**Selecting a breed**

Selective breeding (also called artificial selection) is the process by which humans use animal breeding to selectively develop particular phenotypic traits (characteristics) by choosing which typically animal males and females will sexually reproduce and have offspring together. Domesticated animals are known **as breeds**, normally bred by a professional breeder. Two pure bred animals of different breeds produce a crossbreed. In animal breeding, techniques such as inbreeding, line breeding, and out crossing are utilized. **Different types of birds**

• **Small Pet Birds.** Cockatiels. Lovebirds. Small Parakeets. Parrotlets.

• **Medium Pet Birds.** Caiques. Small Conures. Lories & Lorikeets. Large Parakeets. Pionus Parrots. Poicephalus.

• **Large Pet Birds.** African Greys. Amazons. Small Cockatoos. Large Conures. Eclectus. Hawk Headed Parrots. Mini-Macaws.

**Feeding and Management of birds stock**

Poultry feed is food for farm poultry, including chickens, ducks, geese and other domestic birds. **Before the twentieth century**, poultry were mostly kept on general farms, and foraged for much of their feed, eating insects, grain spilled by cattle and horses, and plants around the farm. This was often supplemented by grain, household scraps, calcium supplements such as oyster shell, and garden waste.

As farming became more specialized, many farms kept flocks too large to be fed in this way, and nutritionally complete poultry feed were developed. **Modern feeds** for poultry consists largely of grain, protein supplements such as soybean oil meal, mineral supplements, and vitamin supplements. The quantity of feed, and the nutritional requirements of the feed, depend on the weight and age of the poultry, their rate of growth, their rate of egg production, the weather (cold or wet weather causes higher energy expenditure), and the amount of nutrition the poultry obtain from foraging. Lactose fermentation of feed can aid in supplying vitamins and minerals to poultry. Egg laying hens require 4 grams per day of calcium of which 2 grams are used in the egg. Oyster shells are often used as a source of dietary calcium. Certain diets also require the use of grit, tiny rocks such as pieces of granite, in the feed. Grit aids in digestion by grinding food as it passes through the gizzard. Grit is not needed if commercial feed is used. Calcium iodide is used as supplement of iodine.

**Eggs**

**Selection:** It is always desirable to select eggs of about 58 g each. Uniform sized and oval shaped eggs are good. The egg shell should be of uniform thickness, texture and color so that the warmth can uniformly spread during incubation. In case of white shelled eggs, all eggs for incubation should be free from tints.

**Collection**

• Collect eggs at least twice a day, especially in hot weather. The first collection should be before 10 a.m. Start by collecting those eggs with no chickens on them. Then carefully lift up those hens sitting in nests, quickly remove any eggs from the nest and put the hens back on their roosts.

• Don't leave eggs in the nest for long periods of time, as they will get dirty and can break.

• Never stack eggs more than five layers high. Anything higher than this will increase the chances of breakage.

• Keep your eggs at a constant temperature until you wash them. Cooling down eggs before washing can cause the egg shell to contract, and any dirt or bacteria on the egg can seep into the egg through its pores.

**Preservation:** The simplest solution to preserving eggs is to simply keep them cool. Eggs have a natural coating on the outside that helps keep the egg inside from spoiling. If that's washed off, the eggs must be refrigerated. Unwashed eggs, however, can be stored in a cool closet or back room for weeks.

**Marketing**

The marketing chain begins at the laying farm where eggs are gathered, packed and refrigerated. On many farms, the grading and packing are done on the farm. At other farms, eggs are picked up several times a week by the grading station’s refrigerated trucks. At the grading station, the eggs are washed, sorted by size, graded for quality and packed into cartons.

Ideally, eggs move from the grading station to the store or store warehouse three to five times a week, depending on available storage space. Many large supermarket chains receive all their eggs at warehouses from which the eggs are distributed to individual stores. Individual retail outlets need both adequate refrigerated space in the back and refrigerated self-service counters out front to merchandise eggs properly.

Sales techniques depend on the local retailer and, sometimes, the supplier. Sales are often stimulated by attractive cartons and point-of-purchase displays as well as advertising and consumer education activities.

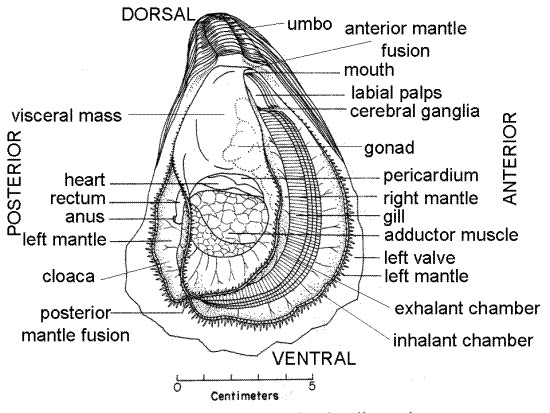
**Pearl industry**

**Pearl formation**

Pearl formation is a rare and accidental phenomenon. Pearls are the result of a biological process—the oyster’s way of protecting itself from foreign substances. It takes about 2-6 years for attaining a good diameter. The longer the time the bigger would be the size of the pearl which develops within span of 3-4 years are very good in luster whereas those which develop for more than 6 years, lose their luster. This is due to excessive deposition of calcium carbonate, which is deposited in concentric rings. Pearls cannot be produced in all the oceans (only warmer water oceans). They are more common in Indian Ocean, coast of China, Japan and Pakistan.

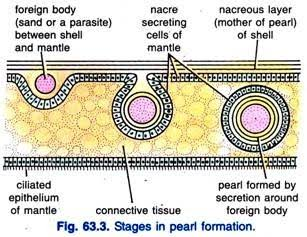
Pearl is produced by bivalve mollusk belonging to:

Class: bivalvia, Family: pteriidae, Genus: pinctada

Some of the selected species are able to produce pearl and they are P. vulgaris, P. chemnitzi, P. margaritifera, P. anomiodes, and P. atropurpurea. These are

Commonly known as ‘Pearl oysters’. Besides this few other marine molluscans are able to produce pearl but their product is of inferior grade and does not have economic value.

Not only the marine bivalves but some of the fresh water bivalves too are able to produce pearl e.g., Unio and anodonta species but they are of low grade and have no luster and economic value. Species of P. maxima and P. margeritifera are bigger in size and much healthier so they produce pearl of bigger size and best luster.

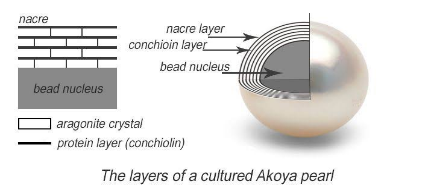
**Size of the Pearl** depends upon the size of the foreign particle, health and age of oyster and condition of sea water. A smaller nucleus requires more deposition as compared to a bigger one. In the same way, the shape of the foreign particle is also responsible for the shape of the pearl.

**Composition of Pearls**

1) Water: 2.4% 2) Organic matter: 3.5-5.9%

3) Calcium Carbonate: 90% 4) Residue: 0.1-0.8%

**Collection of Oysters**

 The oysters are collected from the bottom sea by divers. Divers are pulled by large luger boats in the direction of the tidal flow. Oysters are generally located on a flat rock bottom and are usually covered with marine animals and a thin layer of silt. Therefore, it is often very difficult for divers to recognize them. The divers usually have got training for proper diving into the sea water since their childhood for the search of seashells and seaweeds. An experienced diver can remain under water up to about one and half minute and can collect 2 to 10 oysters per dive. The best time for diving is from the early morning to mid day. The best period for the collection of oysters is of two months in the summer season when the water is nearer and the water is calm.

**Rearing of Oysters**

The collected oysters are stocked and reared in special type of cages called rearing cages. These cages are well protected from natural enemies of oysters like Octopus, Eel and Devilfishes etc. The collected oysters are first cleaned and then placed into culture cages for a period of about 10 to 20 days to recover the strain due to excessive handling and for the physiological adjustment to shallow water conditions.

**Insertion of Nucleus**

The insertion of nucleus as foreign particle is very much technical process and is of great importance for pearl industry. A number of methods are devised but most practicable and efficient method is one adopted by Nishikows. In this method a piece of mantle of living oyster is cut off and inserted together with a suitable nucleus inside the living tissue of another oyster. Following steps are taken for the insertion of the nucleus;

1. **Fitness of oyster for the operation**

The selected oysters for the insertion of the nucleus should be healthy and strong enough to overcome the shocks during operation. It is suggested that if the ovaries and testis of oysters are got rid off they would be more resistant to the shocks of operation. For this purpose, oysters are dipped into cold and warm currents of water alternately which initiates them to eject their sperms and eggs in case of males and females respectively. Before operation, oysters are kept under stress of suffocation. As a result, they start to open their shells and at once a bamboo piece is inserted between the gaps of two shells due to which shells may not be closed again.

1. **Preparation of graft tissue**

The piece of tissue which is inserted inside the mantle is called as ‘Graft’ tissue. A strip of about 7 x 0.75 cm is cut from the edge of the mantle of healthy oysters by sharp knife. This piece is smoothed clean and washed off. The border gill piece is removed by sharp scalpel. Now, this tissue is trimmed to 2 to 3 cms long narrow strip and again cut transversely into small squares according to the size of nucleus for insertion. These squares are kept in sea water at 22 degree centigrade where they can survive for about 40 hours. The outer edges of these graft squares must be known because these nacre secreting cells are found only on the outer surface of mantle so it is essential to keep the outer surface in contact with the inserted nucleus.

1. **Preparation of Nucleus**

Although any small particle may function as nucleus to initiate the pearl formation but it reported that ‘calcareous nucleus’ is the best because the deposition of nacre was found to be more satisfactory on calcareous nucleus as compared to any other particle. Best nucleus is formed by the shell of mollusks with heavy deposition of calcareous shells. Such types of mollusks are easily available in India but Japan depends upon U.S.A. for good quality of calcareous shells.

1. **Insertion of Nucleus**

For the insertion of nucleus, oysters are fixed in a desk clamp in the position of right valve facing upward. Mantle folds are smoothly touched to expose the foot and the main body mass, followed by an incision into the epithelium of the foot and a slender channel into the main mass. Suddenly, one graft tissue piece is placed into the channel and the nucleus is placed over the raft tissue which functions as a bed for the nucleus. Now the bamboo peg is quickly removed and oyster is closed automatically. For the insertion of the second nucleus, similar operation is performed from the left side in the gonadial tissue and third insertion should never be tried. The operation period should not increase beyond 30 minutes and the oysters cannot survive beyond one hour of operation period. So operation and insertion of nucleus should be performed by experienced persons.

1. **Post operational care**

Nucleated oysters are placed into cages and suspended into sea water and attached with floating rafts to a depth of 2 to 3 meters for about 6 to 7 days to recover from shocks due to operation. Now oysters are examined properly and dead individuals are removed from cages. Sometimes, few oysters expel out the nucleus from the body due to heavy shock. Nowadays, it is examined by X-rays whether oysters are having nucleus or not. The pearl oysters grow best in warm shallow waters generally not more than 40 meters deep.

**Harvesting of Pearls**

Pearls are harvested in months of December to February which may slightly vary according to climatic conditions of the industrial area. After the completion of 3 years of insertion of nucleus, pearl oysters are harvested from the sea and pearls are taken out from the shell. Collected peals should be thoroughly dried after the harvest to prevent loss of luster.

**Pearl industry**

Although pearl industry may be established only on natural basis of pearl formed by oysters in the natural conditions but an artificial device to insert the nucleus as foreign particle in the shell of oyster has proved useful for the production of pearls in greater number.

**Problems of pearl industry**

Theoretically pearl culture appears to be very much easy but practically, several problems crop up during culture. Number of enemies like eels, octopus and devilfishes etc. destroy the oyster. The lethal cold water, low salinity of water, turbidity of water and high range of temperature variation hamper the pearl industry by affecting the proper rearing of oysters.