

# Indian Island Field Manual



# A **thumbnail guide** brought to you by

# KWIAHT

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# **KWIAHT**

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# The purpose of this manual

Kwiaht volunteers have monitored habitat conditions and wildlife at Indian Island since 2009. Data collected each year on 8-10 spring and summer minus tide cycles have revealed a number of trends that can be attributed to development and street runoff (changes in bivalve species composition); disturbance of beaches by visitors (juvenile crab diversity and abundance); and climate change (sea star and sea slug diversity and abundance, timing of fish spawning). Volunteer monitoring has also shown that some resources at Indian Island, such as eelgrass and eelgrass-reliant fish species, have remained healthy or increased despite substantial annual fluctuations.

Now beginning its twelfth season, the Indian Island Marine Health demonstrates the critical need for long term ecological studies in an endlessly changing world. Taken alone, no one- or two-year data set could have accurately described the trajectories of particular species at Indian Island, or convincingly identified the larger forces shaping this small island's ecosystem.

This handbook is a tribute to the volunteers that have studied and protected Indian Island all these years, and it is intended for the training of future "community scientists". A few words of explanation now about what this book contains and how it is organized.

Common names are followed by current scientific names. Although scientific names occasionally change due to reorganizations based on new anatomical studies and genetic sequencing, they are much more stable and universal than local American English common names, and it is important that you learn them – even if you use common names in most of your interactions with visitors.

Many species we have recorded at Indian Island are not described in detail here because they are rarely seen, or mainly only seen in winter or underwater. Plankton are also omitted because they can only be seen or identified under a 40-X or better microscope. But if you learn to recognize the animals in this manual, you will be able to identify the great majority of things that visitors bring to show you!

Additional macro-invertebrate and vertebrate species of interest that have been recorded at Indian Island are listed in the back of this book, and future editions will include images and full description of more of them-and perhaps some species we have not yet encountered.

# History of Indian Island



Before Euro-Americans settled on Orcas Island, there was a Coast Salish village on the waterfront where the county park is today. It was called Čəlx<sup>w</sup>esıŋ (sounds like chulx-weh-sing with the -x pronounced like the -ch in *loch* in Scottish), and it probably looked like this photo of a 19<sup>th</sup> century Coast Salish village on Vancouver Island. The houses were made of split-cedar planks lashed to a post-beam frame of cedar logs. A village could house up to a thousand people, and had many outlying production centers. The Eastsound village had reef-met fishing sites at West Beach and Point Doughty, and clam beds around Indian Island and several other East Sound beaches. There were also camas (*Camassia leichtlinii*) gardens on top of Indian Island and on level ground where the shops and restaurants are today. The families that lived here spoke the Saanich, Samish and Lummi dialects of Northern Straits Salish, and many remained here working alongside their Euro-American neighbors until the 1910s. The Cayou family "proved up" a homestead at Deer Harbor, and built Orcas island's first salmon cannery there. Henry Cayou was a county commissioner. Cayou descendants are still active in Tribal and island cultural and economic life.

A settler's cabin built on Indian Island ca. 1890 was demolished by 1925. From 1915 to the 1930s, Templin's Wharf extended from Main Street out past Madrona Point on the east side of Indian Island. Fourth of July fireworks were shot off from Indian Island for over a century, and during the Depression, when fireworks were too expensive for islanders, a load of dynamite was lit instead–blowing off the island's southwest corner!

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# Inter-tidal ecology

Life in the borderland between land and sea-the inter-tidal zone-is driven by the 12.5-hour lunar tide cycle. The timing and height of tides vary daily, seasonally, and annually. Tides are greatest when the Earth's elliptical orbit takes it closest to the sun. Tide times shift by roughly 50 minutes every day because the Moon take a little more time to circle the Earth than one day. As a result, parts of the inter-tidal zone are only submerged for a few days to weeks of the year; and other parts are only exposed to the air for a few days to weeks. Depending on the slope or gradient of the seashore, the inter-tidal zone can be very narrow and vertical (rocky cliffs) or very broad and level (sandy beaches). Since waves only travel on the surface, the inter-tidal zone is also particularly energetic, buffeted both by winds and by waves. Its inhabitants must hang on tenaciously, hunker down, or bend flexibly in order to avoid being swept away!

It's useful to think of the inter-tidal zone as composed of at least five habitats that experience more or fewer changes on average each year at Indian Island.

At the upper edge of the inter-tidal zone are plants that tolerate salinity, but cannot survive long-term immersion in seawater: the "spray zone". At Indian Island this can be seen on the edges of the rocky bluffs, where yellow-flowering Indian celery, and pink-flowering sea thrift are conspicuous in spring. Shorebirds such as killdeer and black oystercatchers nest in this habitat.

Orange and black lichens dominate the rocks that are submerged by the highest tides of the year. Just below the lichens is the first horizontal band of invertebrate encrustation: barnacles, also some dark blue mussels, and scattered oysters (the Pacific oyster, not a native, but raised in oyster farms). These animals are submerged for a time *every day*, which is when they feed. But they can close their valves and survive during the daily low-tide cycle exposed to warm sunlight or in winter, cold air and winds. They can live for hours sealed with a little seawater inside their shells. If you look carefully, you can find limpets hunkered down among the barnacles.

One of the only animals at Indian Island that is well-adapted to the barnacle zone is the five-armed ochre star, which seeks shelter in crevices and in the shadow of larger rocks and boulders when the tide is out. This species comes in a multitude of combinations of purple and orange, and can tolerate long exposures to the air if it can remain moist. Ochre stars specialize in eating sedentary inter-tidal shellfish.

Many other inter-tidal animals seek shelter beneath the rocks and coarse gravels strewn around the island's beaches. Protecting these animals from exposure, heat, and dehydration is the reason for discouraging visitors from tipping rocks to peek beneath, Small crabs, from juveniles the size of lentils to adults an inch or two in diameter, are a large part of the "under rocks" community, together with juvenile sea stars (including the rare brittle stars), some worms including leaf worms and peanut worms, and little colonies of tiny encrusting animals such as bryozoans and ascidians. Gunnels and midshipmen nest, lay eggs, and rear beneath rocks along the wetter, lower parts of the beach, emerging only when the tide floods and submerges their hideaways. On the southerly beaches of Indian Island, bright red burrowing sea cucumbers can be seen wedged under rocks in an inch or two of water.

Although most clams and other animals that burrow into the substrate for safety are found beneath sandier beaches on the town side of the bay, many large horse clams also wedge themselves deep down in the gravelly beach surrounding Indian Island where only their leathery brown siphons are ever exposed. They "spit" periodically as part of filter-feeding and breathing. Most horse clams have house guests: mated pairs of small white pea crabs that brood their offspring inside the clam.

At roughly 0.0 to -1.0 feet of tide, the beaches of Indian Island meet extensive eelgrass meadows that extend down to about -10 feet or more in places. The shallowest parts of the meadow closer to town are mainly the non-native Japanese eelgrass, which has relatively short narrow leaves. Most of the meadow is native *Zostera marina*, and home to a diverse fish and invertebrate community–much of which moves in and out of the bay with the tides.

Permanent residents of the eelgrass meadow include horse clams, and ghost or mud shrimp, whose burrows are marked by large sandy "volcanoes" several inches high. Each shrimp's burrow is shared with commensal bivalves, worms, and crustaceans: a tiny community, protected by the shrimp's claws. When eelgrass leaves grow tall in summer they covered in tiny shrimp, snails, sea slugs and red algae that attract a helmet crabs, red rock crabs, Dungeness crabs, sunflower stars, pink short-spined stars, and many species of fish-notably bay pipefish, shiner perch and striped perch, tubesnouts, young flounders and soles. In some years, Pacific herring spawn in the meadow and spray their eggs on eelgrass and kelps. Squid often spawn in the bay as well, sticking their gelatinous egg masses to the sandy bottom at the deep end of the meadow.

There is little native kelp around Indian Island; however, since 2010, *Sargassum* has spread along most of the west side of the island This dense brown non-native kelp is often associated with kelp crabs and shrimp, and is forming a new "zone" with its own distinctive community. In summer, Indian Island is also frequently covered in an impressive web-work of filamentous green algae, or the reddish brown remains of a "bloom" of diatoms or dinoflagellates. Blooms are associated with warmer summers. Warmer summers have also stressed inter-tidal animals, which are fewer–and less diverse–than when monitoring began at Indian Island in 2009.

# **Bivalves**

# Phylum Mollusca, Class Bivalvia

Bivalves are mollusks-animals with a soft, non-segmented body and often a flexible muscular foot-that are distinguished by living within a pair of carbonate shells. They have both a foot and a siphon, a tube for sucking water inside the body cavity to filter out food particles and absorb oxygen. Bivalves may be free-living (such as scallops), buried in the substrate (many clams), or attached to the substrate by part of their shell (oysters) or by a fibrous byssus (mussels). Some (like scallops) have simple eyes, and a few can move rapidly with "jet propulsion" (water jets) or use their foot to roll along the sea floor. At Indian Island, the greatest diversity of bivalves is buried in the sandy to muddy beaches on the town side of the bay; but mussels and oysters are common in the lower barnacle zone, attached to rocks, and horse clams are buried everywhere!

Infaunal (buried) bivalves are useful indicators of substrate texture. Coarse substrates such as gravelly sand are home to large, thick-shelled clams with powerful feet and long siphons; whereas small, fast-growing, thin-shelled clams thrive in soft fine sand and muddy tideflats.

Clam-harvesting is ordinarily lawful on public beaches with a state shellfish license; but Fishing Bay and Indian Island are almost always closed by the state Department of Health due to pollution and harmful algal blooms.

# Nuttall's cockle

# Clinocardium nuttallii

These large tasty bivalves with ridged shells can grow to five inches. Ordinarily buried in the sand, they often emerge after algal blooms or storms using their long narrow orange feet to roll them along the beach.



# Tresus capax

Very large fat clams with a thick brown siphon that does not retract completely inside the shell. Buried deep in gravelly beaches, horse clams can live for 30 years and weigh over 5 pounds. Geoducks, have proportionally smaller bodies and longer siphons, and tend to live in deeper sub-tidal habitats.



#### **Butter clam**

#### Saxidomus gigantea

Butters were popular with native peoples who smoked them. The large shells (to six inches) are heavy with fine concentric growth rings (they can live 20-25 years). Viewed edgewise, they have a rippled pink "smile". Unlike horse clams the siphon retracts completely.

#### Steamer, or Littleneck clam 🛛 😽

#### Leukoma staminea

The most popular species with clam-diggers today, steamers are characterized by having fine radial as well as concentric lines on the shells. Very old ones (up to 20 years) may be nearly three inches. Nonnative commercially grown Manila clams are more oval and rarely seen at Indian Island.

#### Baltic and Bent-nosed clams

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#### Macoma baltica, Macoma nasuta

Relatively small. brittle thin-shelled clams with white worm-like feet, typically buried in muddy beaches. A Baltic clam is shown here. Bent-nosed clams are very similar, but are wider and seen edgewise they have a crooked "smile"! Edible but muddy-tasting, and associated with soft, muddy substrates.

# Pacific blue mussel

#### Mytilus trossulus

Favorite food of many sea stars and seabirds, these small oval bivalves are dark blue to black (and very rarely translucent brown) and frequently occur as dense single-species patches. Fast-growing, mussels rarely live more than five years.



# Pacific oyster

#### Crassostrea gigas

These large, fast-growing crinkly-shelled oysters were introduced from Japan in the 1910s to replace native Olympia oysters in commercial shellfish farms. They only occasionally spawn but the larvae circulate widely in the Salish Sea, and most settle individually on rocks or pebbles, the bottom shell sticking tightly.



# **Crustaceans** Phylum Arthropoda

Crustaceans are the main aquatic branch of the Phylum that also includes Insects. Arthropods are the largest group of animals with over a million species, and as their name suggests, they are "joint-legged". They also generally have segmented bodies as well as two or four antennae, from one to eight eyes (simple or compound), and produce an exoskeleton of mineralized proteins that must be shed periodically as the animal grows larger. Unlike insects, crustaceans do not metamorphose during their final ecdysis or molt. Rather, they metamorphose once or twice just after they hatch, and their tiny early planktonic larval forms can look quite unlike adults!

Crustaceans are mainly predators and scavengers. They take many forms but most of the macroscopic crustaceans found at Indian Island are Decapods (crabs and shrimp). There are also some Cirrepedia (barnacles), and a few species of Isopods.

Many crab species congregate in shallow water to mate. Crabs mate clasped belly to belly (not an uncommon sight at the island). The female keeps the egg ball under her plastron (the flat "tail" folded up beneath a crab's belly, which is wider in females), and broods them until they hatch and are swept away by the tides. Juvenile crabs also settle and rear in the warm shallows of Indian Island, sheltering beneath rocks and cobbles when the tide is out.

# Red rock crab

# Cancer productus

Large with a heavy exoskeleton and massive nippers, these crabs are year-round residents of the eelgtass meadow. They rest half-buried in the sand so watch your step! Juvenile red rock crabs (at about one inch) have a fan-shaped carapace and can be candy-striped or have other red-and-white patterns.



# Dungeness crab

#### Cancer magister

Familiar from fish markets, this crab has a serrated fan-shaped carapace, brownish tan in color, but its nippers and underbelly are pale. Juveniles look the same. The Graceful crab, *Cancer gracilis*, differs only by having one extra notch behind the widest point of its carapace... and being quite aggressive! Shown here is a Dungie with a plastron-full of eggs.

# Black-clawed crab

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# Lophopanopeus bellus

These small aggressive crabs also have a fan-shaped carapace but it is not serrated, and is usually dark brown or gray and white, with black tipped nipper (like red rock crabs), although some individuals can be neon blue or green. Tiny juvenile black-clawed crabs are very abundant sheltering under rocks.

# Purple shore crab

#### Hemigrapsus nudus

Small sturdy crabs to 2 inches, often beneath rocks, reddish-purple in color. The carapace is roundish, and the eyes are far apart, unlike *Cancer* and black-clawed crabs where the eyes are close together in the middle above the mouth. This crab is "naked" because it lacks the hairy legs of green shore crabs.

# Yellow, or Green shore crab

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#### Hemigrapsus oregonensis

Smaller and much more abundant than the purple shore crab, this species has an oblong yellow-green carapace, with the eyes widely separated almost at the far corners of the "face". Active even when the tide is out, green shore crabs can form conspicuous mating pile-ups in shallow water.



# Flat-top porcelain crab

#### Petrolisthes eriomerus

These dark reddish purple crabs are small and thin with a round carapace, large flat triangular nippers, and very long whip-like antennae. They are filterfeeders that shelter under rocks, and mate every summer at Indian Island. Don't handle! If frightened the crab will autotomize one of its claws!

# Helmet crab

#### Telmessus cheiragonus

Large, thickly bristly, helmet crabs are fast-moving predators that hunt in eelgrass meadows and bury themselves in soft sand when resting. Like *Cancer* crabs, helmet crabs will break and eat other crabs, as well as snatching and slicing fish with their sharp nippers.

# Northern kelp crab

#### Pugettia producta

The largest crab at Indian Island, though chiefly seen in winter when it mates in tide pools. The carapace is smooth, olive green, with a pair of sharp "horns" in front. The first pair of legs are long with narrow nippers used to snip kelp or snatch smaller animals. Males have conspicuous larger nippers and can have bright red patterns on their underside.

# Graceful kelp crab

#### Pugettia gracilis

Small enough to rest in your hand, these crabs have proportionally a small roundish carapace and long spidery legs. They tend to "decorate" themselves a little with sponges, hydroids, sea squirts or other tiny encrusting animals. Eelgrass meadow residents, their bodies brownish and softly bristly.



# Slender decorator crab

# Oregonia gracilis

Generally quite small, these crabs have pear-shaped softly bristly brown bodies with a pronounced long snout and thin spidery legs. They decorate heavily, to the point that they are difficult to see until they move. They decorate with whatever tiny sedentary animals or seaweeds are at hand, and when hungry, they may eat the decorations!

# Acorn barnacle

#### Balanus glandula

Barnacles begin life as tiny free-swimming animals that look like other larval crustaceans; but then they settle on hard surfaces and grow thick armor plates. Barnacles absorb oxygen from the air when exposed. Hermaphroditic, they reproduce profusely. Smaller animals make homes in their empty shells. Shown here with a juvenile Katy chiton (see below).

# Eelgrass isopod

#### Idotea wosnesenskii

Green to match its habitat, this fast-swimming large (up to two inches) omnivore is often found in the Indian Island eelgrass meadow. Unlike most other crustaceans, these isopods have no larval stage; the eggs hatch tiny copies of the adults. Be careful when handling: this species bites!

# Pale beach hopper

#### Megalorchestia columbiana

Beach hoppers are large (nearly an inch) inter-tidal gammarid amphipods that feast on decaying wrack along the tides' edge. They dig burrows, emerging mainly at night, and form colonies. Amphipods have mitts with venomous claws on the first pair of legs (gnathopods) that can be used to subdue small prey.



# Echinoderms Phylum Echinodermata

Their name means "spiny skin", and many but not all groups of echinoderms have short, prickly spines dotting their skins. Unique among animals they have pentagonal symmetry, with their tiny, soft hydraulic tube feet arranged in five rows. Sea stars have at least five "arms" (up to thirty in sunstars) that can regrow if lost, and some species can aututomize. The five-toothed mouth is below, the anus above, and there may be simple eyes at the tips of the arms that can detect light levels but not colors or shapes. Sea stars have a complex hydraulic vascular system that uses pressure to move the arms and tube feet but, astonishingly, the tube feet actually use a chemical glue to stick to the substrate! Most sea stars are predators, and many prey on other stars.

Sea cucumbers (Class Holothuroidea) differ a lot from the sea stars (Class Asteroidea) and sea urchins (Class Echinoidea).. Cukes are soft-bodied, basically a bag with the mouth at one end and anus at the other. Around the mouth are arrayed five dendritic retractable tentacles that sweep food particles out of the water. Tube feet in several species are very long for anchoring the animals in crevices or atop rocks; while other species use their tube feet to crawl like sea stars. Cukes appear to use pheromones to attract mates, and we have observed the number of burrowing cukes at Indian Island increase sharply in early summer!

Sea star wasting (SWS) reduced Indian Island ochre stars by roughly half in 2014 but they made a full recovery in two years. SWS still kills a few each summer.

#### **Ochre star**

#### Pisaster ochraceus

Abundant at Indian Island, these stocky five-armed inter-tidal shellfish predators come in varied colors that affect how quickly the sun warns them. Ochre stars have only sunstars and gulls as predators, and pile up in cool shady spots during low tides to beat the heat and stay moist.

# False Ochre star

#### Evasterias troschelii

Uncommon and easily mistaken for an Ochre star, this species has proportionally longer arms, and its spines form a different pattern. Usually it is brown or grayish in color, and is less adapted to exposure than Ochres, although its diet is much the same.



# Short-spined star

#### Pisaster brevispinus

A very large, usually pink five-armed star that preys on clams, digging them up from the sand. Likely to be seen creeping through the eelgrass meadows at Indian Island, or working for hours to days slowly excavating a large bivalve. Up to 24 inches in size.

# Sunflower star

#### Pycnopodia helianthoides

The largest sea star in our waters, with two dozen or more rays or "arms," this species varies in color but is easily recognized by its limp, soft body with large sharp spines. Fast-moving for a sea star, it is a predator of crustaceans and other sea stars. And is known to congregate in deep water. Occasionally one is stranded on Indian Island.

# Leather star

#### Dermasterias imbricata

These stout sea stars lack spines and have a leathery texture. They target soft-bodied prey, e.g. anemones, swallowing them whole,unlike Ochre stars that evert their stomachs inside the shellfish they eat. Leather stars often have a commensal scale worm that clings to its underside near the mouth.

# Pacific blood star

#### Henricia leviuscula

An uncommon visitor to Indian Island, more likely to be seen in deep water, the blood star has long narrow rays, a scaly or sandpapery texture, and is always red-orange. Unlike the other stars at Indian Island, blood stars are grazers on tiny animals and algae coating submerged rocks.



# Daisy, or crevice brittle star

#### Ophiopholis aculeata

Brittle stars are not Asteroidea but their own Class Ophiuroidea. Unlike sea stars they have segmented rays, five to nine, which they can aututomize. Daisy brittle stars shelter in crevices and use their long "arms" to retrieve tiny animals or bits or detritus. The central disc is no more than 3/4-inch diameter.

# Red sea cucumber

#### Cucumaria miniata

Bright red with dense feathery tentacles, this species is commonly seen wedged under the rocks at Indian Island in shallow water. It is a suspension feeder that sweeps tiny detrital particles out of the water. Like many other sea cukes it swells up if handled and may eviscerate through its anus if it feels threatened.

# California sea cucumber

#### Parastichopus californicus

A large (to 20 inches) free-living sea cuke that often can be seen slowly creeping along submerged sand flats and eelgrass meadows. It feeds on detritus on the sea floor, and has short tentacles that are rarely extended. The thorn-shaped protrusions on its red body are actually soft and rubbery!

# White sea cucumber

#### Eupentacta quinquesemita

This small pale sea cuke lives inside rocky crevices, anchored by a web of tube feet. Its tentacles look like bare white tree branches when fully extended. It seasonally eviscerates in the autumn, for reasons that remain unclear, re-growing its digestive organs in a few weeks.





# **Opisthobranchs** Phylum Mollusca, Class Gastropoda

Opistobranchs are a large, diverse, polyphyletic group related to chitons amd snails that includes several different groups of "sea slugs," including the true sea slugs with exposed gills (Nudibranchs) as well as "side-gill slugs," "bubble shells" and "sea hares". All of these animals have a large muscular foot like snails and terrestrial slugs but are soft bodied, lack eyes, rely on taste or smell (chemosensation) to navigate their world and on toxic compounds in their skin to deter predators. Most are grazers, but some are predators on smaller, slower or sedentary invertebrates; and some swallow algae alive and become temporarily photosynthetic. Some swallow bacteria that glow.

Many Nudibranchs have long spaghetti-like or feather-like flesh tabs on their bodies called *cerata* that contain respiratory organs. Sea slugs often autotomize their cerata if threatened, and as a rule, most are simply too delicate to handle. Although sea slugs are usually seem creeping along the substrate like snails, many can swim, too, using a kind of jerky motion. Some are even completely pelagic and have lost their gastropod foot entirely, such as the Hooded nudibranch in our waters.

Sea slugs are hermaphrodites, and many species come to Indian Island to spawn in winter and spring. Slugs line up side-by-side, exchange eggs and sperm, and before they separate, both release a stream of creamy to yellowish fertilized eggs. Many sea slug species at Indian Island produce egg ribbons that look like egg noodles.

# Pacific sea lemon

#### Peltodoris nobilis

A large firm-bodied yellow sea slug up to 4 inches long, covered in small tubercles. There is a random smattering of dark blotches on the skin but not the tubercles. Spawns in spring at Indian Island leaving distinctive rosettes of limp yellowish "egg noodles" on the undersides of rocks.

# Monterey sea lemon

#### Archidoris montereyensis

Easily mistaken with the Pacific sea lemon, this slug has a random smattering of dark tubercles but no spotting on its skin. Both species co-exist in the rocky inter-tidal reef zone at Indian Island, grazing mainly on sponges. Sea lemons are "dorids"–slugs with firm leathery oval bodies.



# Leopard nudibranch

#### Diaulula sandiegensis

This common dorid sea slug has a random pattern of dark rings on its long, ovoid pale gray body. Like the sea lemons it grazes mainly on sponges and can be seen spawning at Indian Island in spring. Its egg ribbons are white and laid in tight little spirals. You may find them in moist rocky crevices.

# Shaggy mouse nudibranch

#### Aeolidia papillosa

This soft bodied aeolid slug is covered with shaggy spaghetti-like cerata and can be grayish, brown, or yellowish. It eats sea anemones. The nematocysts (stinging cells) and symbiotic algae of the anemones get stored in the tips of this slug's cerata, making them dangerous and solar-powered! Usually seen in the eelgrass meadow at Indian Island.

# **Frosted nudibranch**

#### Dirona albolineata

Surely one of the prettiest North Pacific sea slugs, this delicate aeolid is translucent like frosted glass, with white-edged leaf-shaped cerata. Never handle aeolids: they will autotomize their cerata! This one's diet is mainly the tiny snails that live on the eelgrass, such as *Lacuna*, which the slug cracks with its *radula*, rows of teeth embedded in its tongue.

# Northern opalescent nudibranch

#### Hermissenda crassicornis

Small, colorful, with a mass of spaghetti-like orangeand-white tipped cerata, this slug is fragile but also ferocious: while it mainly eats hydroids (saving their nematocysts), and sometimes dines on other small soft-bodied animals such as ascidians or anemones, it will devour members of its own species whenever it encounters them!



# Warty barnacle-eating dorid

#### Onchidoris bilamellata

Yes, these small grayish-brown dorid sea slugs eat barnacles! A bit larger than jelly bean and covered in small tubercles, warty dorids swarm and spawn on Indian Island in winter, feasting on newly settled young acorn barnacles. Some may still be found in wet rocky crevices in May and June. A mating pair is shown here.

# Taylor's sea hare

# Phyllaplysia taylori

Unlike true nudibranchs, sea hares have their gills tucked beneath the mantle and the foot rather than being exposed. This is a gorgeous green and yellow soft-bodied slug with a pattern of dark lines, barely an inch long, that feeds on diatoms and algae stuck to eelgrass leaves and has a seasonal life cycle tied to the summer eelgrass growing season.

# White bubble snail

#### Haminoea vesicula

Unlike true nudibranchs, this small Opisthobranch has a very thin vestigial shell that is yellow to white in color (hence its name) while the body enveloping it is brown. Thousands live in the sand beneath the eelgrassm emerging to graze algae from the leaves, and laying small yellow egg ribbons on the eelgrass in summer.

# Hooded nudibranch

#### Melibe leonina

Flotillas of these translucent greenish-yellow freeswimming sea slugs have surrounded Indian Island in late summer or autumn. They use their "hood" to snatch small shrimp and other crustaceans they hunt in eelgrass meadows and kelp forests. When disturbed they secrete a repellent that smells like watermelon rind.



# Other interesting invertebrates

Many other marine invertebrate may be seen in the Indian Island inter-tidal zone but many are very small or very rare, and unlikely to draw the attention of visitors. Many species of worms burrow through the sandy and gravelly beaches, and close scrutiny of rocks reveals patches of tiny encrusting animals such as sponges (including one bright red species), bryozoans (like crusty orange discs), hydroids, and ascidians (sea squirts) as well as patches of bottle-shaped pale yellow snail eggs. Small snails and hermit crabs are diverse and abundant at Indian Island, too many similar species to attempt to list and describe them here. Occasionally, a ruby-red octopus (*Octopus rubescens*) is seen stranded in a tide pool but be careful if you try to rescue one, as they have a venomous bite! Sea anemones are quite rare, other than the *Metridium* described below, and a "solitary" sea anemone (*Anthopleura sola*) may sometimes be seen half-buried in fine sand in the eelgrass meadow, usually reddish in color.

Conditions at Indian Island are different from other public-access shorelines in San Juan County such as Shark Reef, Obstruction Pass, or Reuben Tarte, where you may expect to see a different suite of species. Conditions are also changing, and we are also always discovering new species at Indian Island with the help of volunteers and interested visitors! Good quality photos are invaluable.

# California market squid

#### Doryteuthis opalescens

A cephalopod mollusk, these animals' shimmering iridescent colors can provide camouflage, distract predators, and communicate. Squid congregate on the south side of Indian Island some summers and leave distinctive translucent eggs cases glued to the sandy sea floor that may wash up on the beach.



# Pale, or frilled anemone

#### Metridiun senile

There are few anemones around Indian Island; most species prefer more turbulent water. This smallish species is brown, tan, or muddy green and catches small crustacean or even fish with the nematocysts in its short thin tentacles. When the tide is out they droop and resemble blobs of brown mucus hanging under rocks.



# Solitary red sea squirt

#### Cnemidocarpa finmarkiensis

"Sea squirts" (Ascidians) are filter-feeders that can be free-swimming, form encrusting colonies, or live as solitary individuals. Each animal has two siphons, while sponges have just one. This red sea squirt is conspicuous in Indian Island tide pools, about one inch in diameter, often sheltering in crevices.

# White leather glove

#### Didemnum albidum

This colonial ascidian is composed of thousands of tiny individuals and looks like sheets of thin white leather. It is most likely to be seen clinging to rocks on very low tides. Like sponges, colonial ascidians are mainly preyed upon by nudibranchs that graze tracks across them like tiny mowing machines!

# Chain tunicate

#### Botrylloides violaceus

This highly invasive non-native colonial ascidian was first seen at Indian Island less than 10 years ago. Our colonies are mainly reddish purple and look like spilt raspberry jam; elsewhere this species can be bright orange. Individual zooids within the colony are not much larger than mustard seeds. *Botrylloides* colonies grow over and smother other encrusting animals.

# Bivalve, or giant, leaf worm

#### Kaburakia excelsea

Thin, translucent, grayish with darker spots, this is an extraordinary marine flatworm of the Acotylea group that seem to slide effortlessly over pebbles and shells-or volunteers' hands. They can grow to four inches but at Indian Island are usually about an inch wide. They are predators of small bivalves.



# Clam worms

#### Nereis vexillosa, Nereis brandti

Apart from a few summer weeks when they take to the water to find mates, looking like sea snakes, these large (to two feet) segmented predators are tunneling in the inter-tidal to sub-tidal sand hunting for prey. They have strong sharp jaws hardened with zinc absorbed from seawater, so handle with care! Colors vary, but red-pink is most common.

# Commensal scale worms

#### Arctonoe vittata, Arctonoe pulchra

This small segmented worm is specially adapted to living as a passenger on larger invertebrates such as sea stars and chitons. Free-swimming juveniles use chemosensation to find appropriate hosts and settle on them, then share bits of the hosts' meals. Only one worm settles on each host, fighting off others.

# **Mossy chiton**

#### Mopalia muscosa

Chitons are Polyplacophorans, mollusks with eight armor plates rather than a single spiral shell or pair of shells like Gastropods and Bivalves, respectively. They are grazers, active underwater but hunkered down tightly on rocks when resting between tides. Mossy chitons have a coarse bristly girdle. The girdle is leathery and black in *Katarina tunicata*.

# Lined chiton

#### Tonicalla lineata

This is our prettiest local chiton, distinguished by a pattern of fine lines on its armor plates. The plates are often green or rose colored; when the animal dies, its disarticulated plates are colorful "butterly shells". Lined chitons graze on coralline algae, and Ochre stars are one of their main predators. Like limpets, they return to the same spot to rest.



# Vertebrates: Fish Phylum Chordata, Class Pisces

Vertebrates at Indian Island of course include birds such as Black Oystercatchers, Killdeer, White-Crowned sparrows, Ospreys, Gulls, and Great Blue Herons; and aquatic mammals such as minks and river otters that visit the island to dine on birds' eggs and shellfish. Most of what visitors see on research days at Indian Island are the fish sampled every two weeks with an 80-foot beach seine set by hand in the eelgrass meadows. Fish at Indian Island fall into two broad groups: year-round residents, and seasonal visitors.

Resident fish are mainly sculpins and flatfish (flounders and soles) that mainly rest on the sandy bottom to snatch passing small prey such as shrimp: they are "sit and wait" predators. Gunnels (Pholidae) are the other large group of residents. They nest in crevices in the rocky reef zone, emerging periodically to cruise over the rocks and kelps for invertebrate prey.

Seasonal visitors include schools of small "bait" or "forage fish" such as smelt and herring, as well as solitary predators such as young greenlings that follow and feed on smaller fish. The eelgrass and rocky reef are both important as spawning and rearing habitat for species that include the forage fish (at least in some years) and large aggregations of non-schooling fish, notably Bay Pipefish and Plainfin Midshipmen, which are unusually abundant around Indian Island in summer. Indian Island is not salmon habitat, but any herring hatched and reared in Fishing Bay are likely to become salmon prey once they leave East Sound!

# **Bay Pipefish**

# Syngnathus leptorhynchus

A large cousin of seahorses specially adapted to lurk camouflaged in eelgrass meadows, where it stands on its tail and sways with the current, snapping up passing small crustaceans. Females deposit eggs on a tumescent brood patch on the belly of the male, who broods the eggs until they hatch. Like eelgrass they come in two colors: green, and the brown-gold of dead leaves.

# Tubesnout

#### Aulorhynchus flavidus

These small slender golden torpedoes school in the eelgrass. They have beaks like pipefish and target a similar diet of small crustaceans. Males build nests in kelp stands that they glue together from of pieces of kelp and several females may lay their eggs in the same nest. Males also brood the eggs to hatching.





# Plainfin Midshipman

#### Poricthys notatus

Virtuosos of the local fish world, male midshipmen find crevices in the rocky reef for nests, then sing to attract mates. Their song is an eerie mechanical buzz. The mated pair defends their eggs together. Midshipmen have a gold belly with rows of buttons (hence their name) that glow at night, attracting a variety of tasty snacks!

# Shiner Perch

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#### Cymatogaster aggregata

Vast schools of these small silvery, yellow-striped fish spend several months in the eelgrass meadows each summer. Females give live birth to dime-sized fry and then leave them at Indian Island to rear in the shallows. Shiner perch are popular prey for the herons, other fishing birds, minks and otters. The one shown is gravid with soon-to-be-born fish.

# **Striped Perch**

#### Embiotoca lateralis

Much less common than Shiner Perch, these goldcolored fish sport fine, neon-blue stripes. They form smaller schools than Shiners, prefer kelps, rocks and docks to eelgrass, and can grow to six inches. They are viviparous (giving live birth) and prey on a wide variety of small snails, worms and other invertebrates.

# White-Spotted Greenling

#### Hexagrammos stelleri

Although adult greenlings are associated with kelp forests and deep rocky reefs, their young tend to rear in shallower waters, But not to prey on "bait fish". Greenlings eat crustaceans, mainly off kelps and rocks; but like rockfishes and Pacific cod, they are safer from larger predators in places like Indian Island. Note the streamlined shape and spots!





# Pacific Staghorn Sculpin

#### Leptocottus armatus

The most abundant resident fish at Indian Island, a fast-growing and aggressive omnivore that has an armored head and sharp branched horns, and can grow to 14 inches. Sculpins often hum if handled, and can survive 30 minutes or longer out of water, They spawn in winter, spraying eggs on rocks that are guarded by males.

# **Penpoint Gunnel**

#### Apodichthys flavidus

Nesting and hunting amongst the inter-tidal rocks, gunnels are slippery, eel-like, and can absorb enough oxygen from the air to survive hours of low tides. Penpoints are the largest and most striking species, usually bright lime green with a small dark eye stripe and can grow to 12 inches. Gunnel nests are full of brightly colored eggs.

# Saddleback, and Crescent Gunnels

#### Pholis ornata, Pholis laeta

Also slippery and eel-like but smaller than Penpoint Gunnels, with subdued lighter markings on brown. The Saddleback has a row of dark round "saddles" the length of its back, while the Crescent has a row of light vertical bars or exclamation marks. Both species are common under rocks, where they nest: a good reason not to turn rocks over!

# Lingcod

#### Ophiodon elongatus

Indian Island is a rearing habitat for this extremely popular sport fish, which means that we only see them as silvery juveniles (up to six inches). They are long and thin, and sometimes mistaken with Snake Pricklebacks, which also spawn and rear at the island in summer. Snakes are longer and very slippery with small mouths; Lings have big long toothy mouths.







# More fish recorded at Indian Island

Only seen as juveniles

Bay goby Lepidogobius lepidus Buffalo sculpin Enophrys bison Cabezon Scorpaenichthys marmoratus ۲ C-O sole Pleuronichthys coemosus ۲ Parophrys vetulus 

Parophrys vetulus English sole Grunt sculpin Rhamphocottus richardsonii Kelp greenling Hexagrammos decagrammus ۲ Northern clingfish Gobiesox maeandricus Pacific herring Clupea pallasii  $\odot$ Snake prickleback Lumpenus sagitta Starry flounder Platichthys stellatus Surf smelt Hypomesus pretiosus Three-spined stickleback Gasterosteus aculeatus Tidepool snailfish Liparus florae