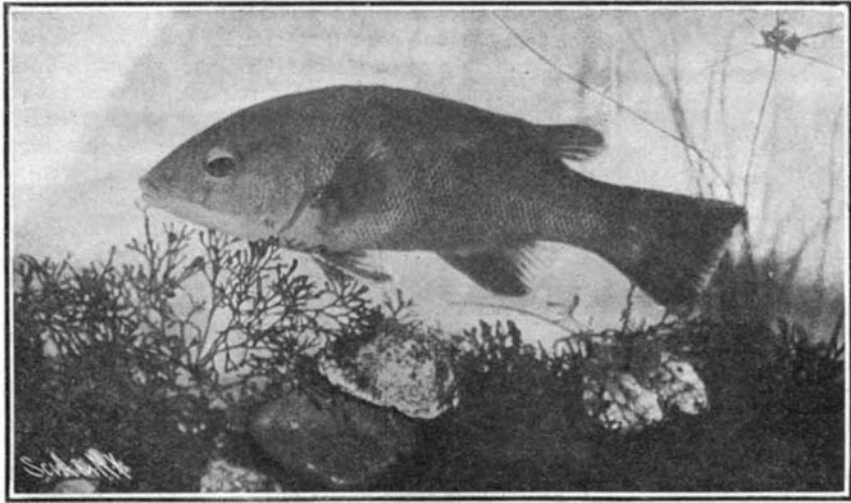


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THROUGH A WINDOW OF THE SEA.

BY CHARLES FREDERICK HOLDER.

Along the great blue current of Japan that sweeps down the California coast, a climatic peacemaker, is strung a chain of gemlike islands. They are the summits of offshore Sierras, a coast range of California that has been partly overwhelmed by the sea, their tops now crested with verdure, and washed by the warm stream that modifies the entire coast. These islands, from twenty to sixty miles offshore, rise from very deep water without premonitory shoals or reefs,



The California Sheepshead.

and could we see them divested of the ocean they would appear like gigantic needles rising from the bottom. All have a peculiar beard, or protecting growth of weed, that constitutes a perfect laminarian forest about them, a giant seaweed growing in water sixty or more feet in depth, and forming a natural wave brake and a home for countless marine animals.

The vines are sometimes one hundred feet in length, vast cables, with broad crimped leaves of a dark olive hue, which assume graceful shapes in the tide; and when one peers down into the turquoise water the scene is often a revelation. A new world is opened up, and the real beauties of oceanic or submarine scenery are appreciated. The great leaves are carried by the fitful currents that sweep these islands in every direction. Sometimes they are extended at full length and appear like a horde of green snakes; again they lie upon the surface, listless and drooping, taking myriads of shapes, and forming nooks and corners of great beauty.

So attractive are these kelpian forests, so fascinating, that what is known as the water glass has been elaborated into a glass-bottomed boat, which virtually has several large plate glass windows through which the passengers may look down into the kelp forests and view a panorama of the sea. These glass-bottomed boats range in size from rowboats in which a dozen people can be taken out, to side-wheel steamers, so arranged that they can float over the forest and view its wonders up and down the coast. One of these odd craft is so large that several hundred passengers can look down through its windows at one time.

Avalon is the headquarters for the glass-bottom-boat men, and their vessels cruise up and down the smooth north coast of Santa Catalina, that appears to be admirably adapted for the purpose, being in the lee and abounding in coves and bays—the mouths of cañons that nearly always are smooth and often like disks of steel. There are no hackmen at Avalon; it is a sort of mountain Venice, and carriages are at a discount. The captains of the glass-bottom boats replace the hackmen of the mainland and cry the merits of their strange craft, each of whom claims to the knowledge of some especially attractive sea meadow or glade over which he will take one.

What the voyager in the glass-bottom boat generally sees, and with the same surroundings, is shown in the accompanying illustrations of animals, taken from the kelp forests of Avalon and adjoining waters under the direction of the writer; in other words, each photograph shows the animal as it has been seen by the writer; and as the various forms have never before been photographed and some have never figured in books, they have an especial interest as a contribution to popular entertainment and exact zoological knowledge.

When the glass-bottom boat starts the passengers are at first regaled with the sandy beach. In three or four feet of water the wave lines are seen, the effect of sea on soft sand, the delicate shading of the bottom in grays innumerable. Now the collarlike egg of a univalve, or the sharp eye of a sole or halibut protruding from the sand. A school of smelt darts by, pursued by bass, and as the water deepens flocks of surf fish, gleaming like silver, appear; then a cormorant dash-

ing after them, or perchance a sea lion browsing on the bottom, or in pursuit of prey. Suddenly the light grows dimmer and almost without warning the craft is in the depth of the kelpian forest. The fitness of the term "hanging gardens" is apparent, as the great leaves appear to rise near the surface, then droop over, forming arches, parterres, and loops, conveying the impression of being suspended at the surface. The color is a deep olive grading to yellow, the leaves a foot or two wide and very long, their edges crimped. Each is seen to be covered with a lacelike network of great delicacy. Fragile plumes wave to and fro, telling of worms or minute Sertularians. Here the tracery is white, the deposit of some animal, gleaming like frosted silver, while others are of lavender hues. The

vagrant beams of light that strike the surface bring out the tints and shades in strong relief. Through a loop of kelp is seen the blue of the deep water, and poised in it, an angel fish of vivid orange tint that persists in taking black through the camera. A school of these fishes swim into view, turning their gorgeous shapes upward and eyeing the strange window in which are mirrored many faces. With them are small fishes of brilliant blue iridescence suggesting the strange vagaries of nature, as the very young angel fishes are almost entirely blue, and called by the skipper electric fishes; but as

they grow the blue merges into yellow and the adult blossoms out in its perfect coat of gold or orange.

On the leaves are singular crabs, red and olive, with square shells, and deeper, in the crevices of the moss-covered rocks, are gigantic spider crabs, mimicking the rocks in shape and hue. The nature of the forest is ever changing. Now great pompons of a dark weed appear, a tint born of the deep sea. It waves gracefully as the slight swell comes in, and as it turns aside, displays the very giant of the starfishes, a huge creature garbed in red with white spikes or tubercles scattered over it, making it a most conspicuous object among the greens. In the crevices are smaller stars; some a vivid red, others dark, with arms like snakes.

Among the weeds long serrated waving spines are seen—the antennæ of the California crawfish, or spiny lobster, which takes the place of the lobster here. Its red, yellow, and brown tints so harmonize with the weed that it is almost impossible for the novice to see it, although he has the word of the skipper that the spines are waving beneath his eyes. At night the crawfish comes out and wanders abroad in these pastures of the sea, and even now he can be seen as the kelp is brushed aside, trim, debonair, ready to dart backward at the slightest warning.

The bottom changes to a finer moss or weed—a deep velvet green, with here and there iridescent tints, and in it lie great sluglike sea cucumbers in brick-red shades. Presto! the captain of the glass-bottom boat transports his passengers to a deep glen in which lacelike weeds rise and poise, forming a natural canopy for long-spined black echini, or sea urchins—formidable creatures, sea porcupines which recognize the presence of some possible enemy and attempt to hide among the weed by plunging deeper into its mazes. Splashes of white tell of a smaller sea urchin, and nearly every nook and corner of this sea forest is inhabited by these aggressive creatures.

The bottom of the sea along this rocky shore is a color scheme of marvelous beauty. Green is the predominating tone, but green in countless shades and expressions. Sometimes a short wiry weed covers the bottom, constantly being waved aside to display other and more attractive colors: weeds in purple and brown, rocks of lavender incrustated with a flaming red sponge, or a mass of pink barnacles from which rises the delicate mauve tracery of their breathing or-

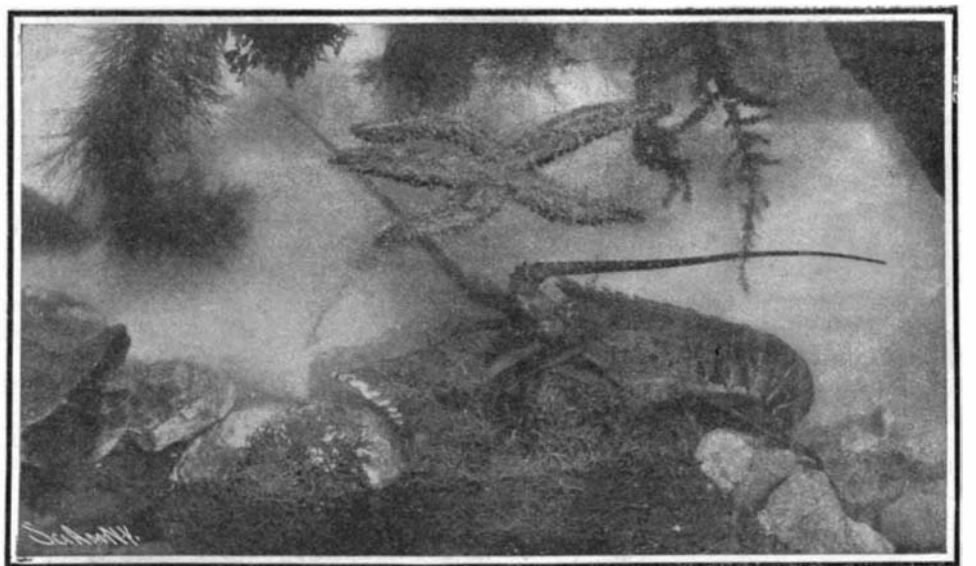
gans. This sea tapestry is constantly in motion, so has the appearance of changing light, shade, and tint, and displaying some new creature to the voyagers of the curious craft with windows looking down into the sea.

The window drifts past strange holothurians, like monster slugs lying on painted rocks, the *dèche de mer* of the Chinese, in which lives the glasslike fish, *Fierasfer*; by hordes of mimic flowers, *Serpulæ*, with crowns of red, white, blue, and seeming gold. The lightest jar on the boat and they are gone, to appear slowly, unfolding like flowers. Near them are tube-building worms, with slender organs; and out from beneath a rock wave the tentacles of the octopus, or perhaps the paper nautilus.

The animals of the hanging gardens are not confined to the kelp in its variety, or to the rocks of the bottom. The blue water where the sunlight enters brings out myriads of fairylike forms, poising, drifting, swimming, the veritable gems of the sea. Some are red as rubies, others blue, like the sapphire; some yellow, white, topaz, green as emerald; or emitting flashes of seeming phosphorescent light. Ocean sapphires they are called, minute crustaceans (*Saphirinæ*), that are in such numbers that some lavish hand might have strewn the water with gems. Sweeping by, in classic shapes, are the smaller jelly fishes; crystal vases, moon-shaped bodies, so delicate that the rich tone of the ocean can be seen through them, then changing their colors to steely blue. Some are mere specters, a tracery of lace; others rich in colors and flaunting long trains. Now the glass floats over a giant four or more feet in length, its body white, blue, with dark chocolate lines radiating upward, while from below swing magnificent coils and flutings, the tail of this living comet that has been seen in Avalon Bay nearly thirty feet in length with a disk nearly two feet across, calling to mind the giant jelly seen by Louis Agassiz that was 125 feet long. Nearly all these pellucid craft move by slow flapping of the edge of the umbrella-like disk; but here is a jelly, the *Physophora*, that has a series of pumps by which it shoots along through the water. No more beautiful object can be conceived than this, ablaze with colors—pink, blue, and quicksilver—darting through the azure waters that form the interstices of the floating garden.

As the boat moves out into deeper water the purity of the aqueous sky is evident, as forty feet below the rocks are seen and the dim shapes of kelp leaves faintly outlined beyond. Here large fishes hide—the graceful sheepshead peculiar to the region, the male with enormous red and black stripes, blunt forehead, the lower jaw white. The female is a radiant creature with beautiful eyes and often red, brown, or white, the colors fading in confinement. These fishes are easily drawn near the boat by judicious display of bait and their graceful postures plainly observed.

Now the window is out over deep water to see the passing of a migratory school of barracuda, thousands of long slender pike-shaped fishes all headed in one direction, swimming slowly. Suddenly they disappear,



California Crawfish (*Palinurus interruptus*).

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as though some shutter had been snapped, and onto the field dash a school of large sea bass, the game fish of this locality. Again the window approaches shoal water, and for several miles follows along the fishes' highway, regaling the passengers with an ever-changing panorama of marine scenery. Now it will be a shoal of myriads of blue perch (*chromis*), a fish that affects the kelp forest, and presents a sharp contrast to it in its vivid blue tint. These fishes delight to bask and sport near the surface, and the window appears full of them as it moves along. Rock bass, singly and in schools, are seen poised in the leaves of the kelp, striped brown and black; spotted rock fish, and here the radiant whitefish, as blue as the water, with long fins, while in the depths other interesting

forms appear, all slightly intensified, magnified by the glass.

In and out, in shallow, where the velvet-like rocks are near the surface; now offshore, following the trail of some vagrant shark, the shallow steamer moves, affording remarkable vistas of the sea and its secrets, and emphasizing the fact that a new method of study has been found in the field of popular science.

Zapon.

The price of shellac, which has been rising for some years, has at the present time reached such an inordinate height that efforts are being made in all directions to find a cheaper substitute. Such efforts, it is true, have so far had negative results, since nothing can entirely take the place of pure shellac, any more than of pure turpentine oil. The finest white shellac especially has been affected by the rise, and its solutions correspondingly; the price of spirits also shows a constant upward tendency, and, in view of the poor potato crops for some time past, we need not hope to see the quotations lowered at present. In this necessity, interest is being aroused in the article called zapon, a product which first appeared about 15 years ago. It makes an excellent coating for all metallic surfaces, German silver, nickel, copper, brass, or aluminium, can also be used on wood or paper, and is a substitute for all the varnishes known under the fancy names of metal varnish, brass varnish, silver varnish, anti-oxide, etc. Zapon has undoubtedly some advantages over the spirit varnishes; but the consumers are conservative, and, partly, perhaps, for convenience sake, keep to the old ways, and show little enthusiasm for zapon, which, however, is making its way forward, and is bound to have a prosperous future.

Zapon consisted originally of a solution of collo-dion-cotton in amyl-acetate and acetone, and it may be supposed that the property of collo-dion which makes it valuable in surgery for excluding air from open wounds, gave rise to the idea of making it the foundation of a sort of varnish. The ultimate constituent of collo-dion-cotton is cellulose, a substance formed from sugar and starch during the assimilation of matter by the protoplasm of vegetable cells. Pure cellulose can best be obtained from cotton, from which the foreign constituents are removed by extraction with water, alcohol, dilute acids, dilute solutions of potash, and finally with hydrofluoric acid, the object of the latter being to dissolve the silicic acid in the cotton. The residue is again cleansed with water. Filter-

paper, in its manufacture, is put through this whole process, and may pass for pure cellulose. Cotton, purified in the way described, with all grease removed, and exposed for a certain length of time to the action of a mixture of one part of nitric acid and two or three parts of sulphuric acid, gives the product called pyrox-yline, or gun-cotton, the well-known violent explosive. The cotton for the manufacture of zapon is prepared in the same way, and its structure is unchanged. It is scarcely necessary to observe that this material cannot be prepared by amateurs, but only in chemical works.

Amyl-acetate is the constituent of zapon which gives the agreeable odor of a fruit-essence.

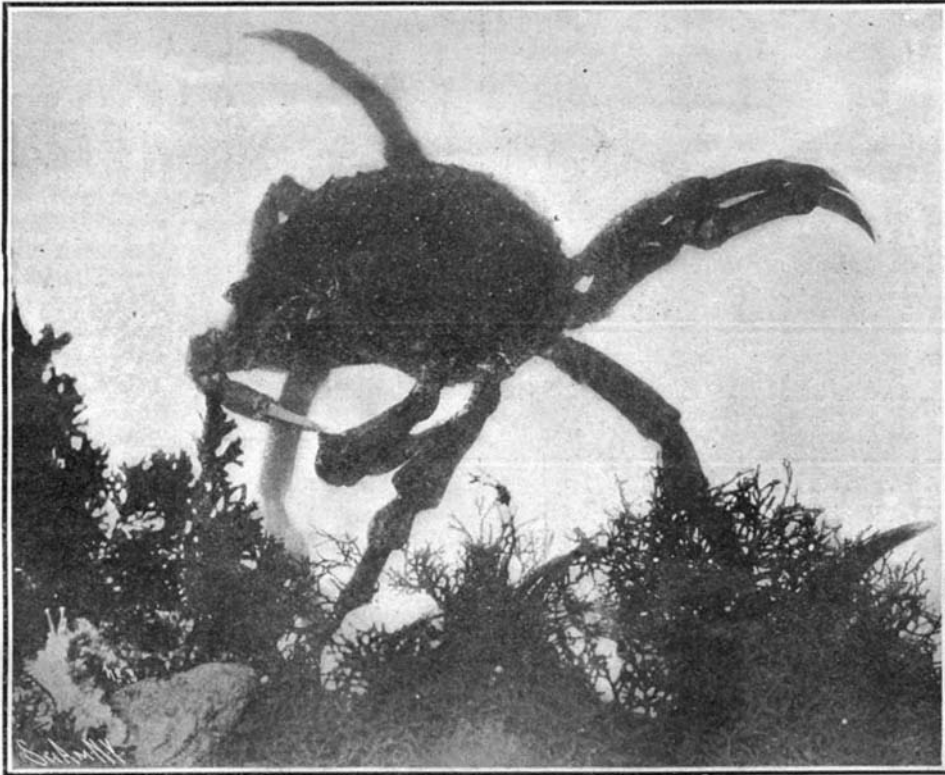
Acetone is a product of the dry distillation of wood,

Zapon can also be made from celluloid, since this material consists ultimately of cellulose. Accurately speaking, it is nitro-cellulose and camphor. The solution is made with the usual agents, or with sulphuric ether, and dilution is with amyl-acetate. Ordinary benzine may be added in small quantities, although this affects the quality unfavorably rather than otherwise. All varieties of zapon may be colored with the familiar soluble aniline dyes, and it is advisable to dissolve the dye in a mixture of equal proportions of amyl-acetate and acetone, and add to the zapon when ready for use. Zapon will not amalgamate with earth or mineral colors.

In working up the above described materials, an occasional shimmer of rainbow colors is an indication of too much dilution. This can be remedied by exposure to the air, whereby some of the liquid is evaporated. If zapon, on the other hand, is streaky, flaky, or crumbly, it needs dilution, but spirits must never be used for this. The zaponizing process must be carried on, if possible, in a warm work-room, and where cold metals are concerned, it is well to warm them. A varnish-furnace has the advantage that particles of grease or moisture adhering to the metal are removed at the same time, and cleanliness is a prime condition for the best work. Zapon may be applied to the surface like paint, or the objects may be immersed in it. It dries very quickly. Being very inflammable, it must not be brought near a lamp-flame, or an open fire. The odor is not injurious to health, though at first somewhat irritating to the throat.—Translated from the Farben Zeitung.

There has long been a demand for some arrangement by which the amount of material remaining in a bolt of ribbon or cloth can

be ascertained at a glance. As a means of doing this the suggestion was made that a tape be wound up with the ribbon, the tape being marked with inches, feet and yards, but when this was tried, it was found that there was a serious discrepancy in the respective lengths of the two pieces. This difficulty has now been overcome by slitting the paper tape at regular intervals, and passing the ribbon in and out through these slits. This innovation, which is the invention of a Chicago ribbon manufacturer, will not only be of great assistance in the shop, where the ribbon may be measured off in the required quantities without the use of a yard-stick, but will be also found to greatly facilitate the work of stock taking, which in the case of ribbons, cloths, and similar materials is a very tedious operation.



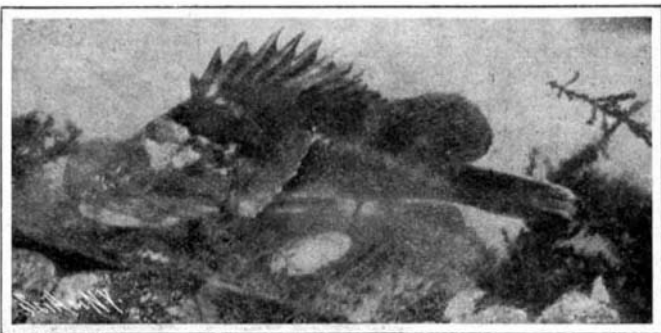
The Giant Spider Crab Dining.



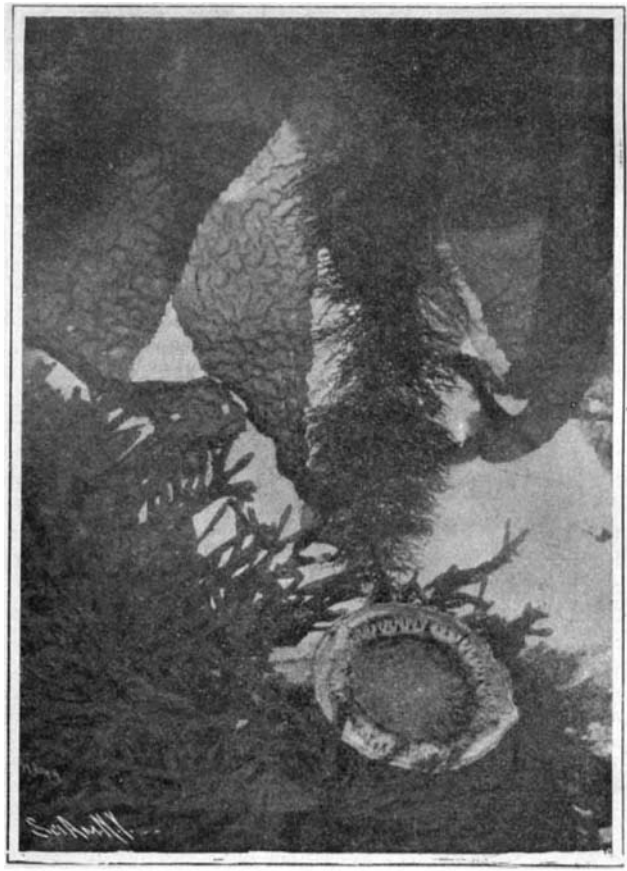
A Large Jelly Fish. Specimens as Long as 30 Feet Have Been Seen.



Glass-Bottomed Boat Off Sea Lion Rocks.



Spotted Rock Fish (*Sebastes vexillaris*).



In the Hanging Gardens. A Perfect Scene in the Kelp Beds of Santa Catalina Under Water.

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having likewise a pleasant odor, and boiling at 56 deg. C. From a mixture of amyl-acetate and acetone, in the proportion of 18:2, and by the solution of five parts of collo-dion-cotton, whose chemical name is coloxylene, in one hundred parts of this mixture, zapon is produced. The matter appears simpler than it really is; for not only is work with these materials accompanied with some danger, but the collo-dion-cotton sometimes obstinately refuses to dissolve, behavior which may be attributed to the manner of preparation. It is advisable for the wholesale consumer to procure from the chemical works concentrated solutions of collo-dion-cotton in amyl-acetate and acetone, and also the latter dissolving agent separately; the mass may then be diluted as needed. Smaller quantities of zapon may be procured ready for use.