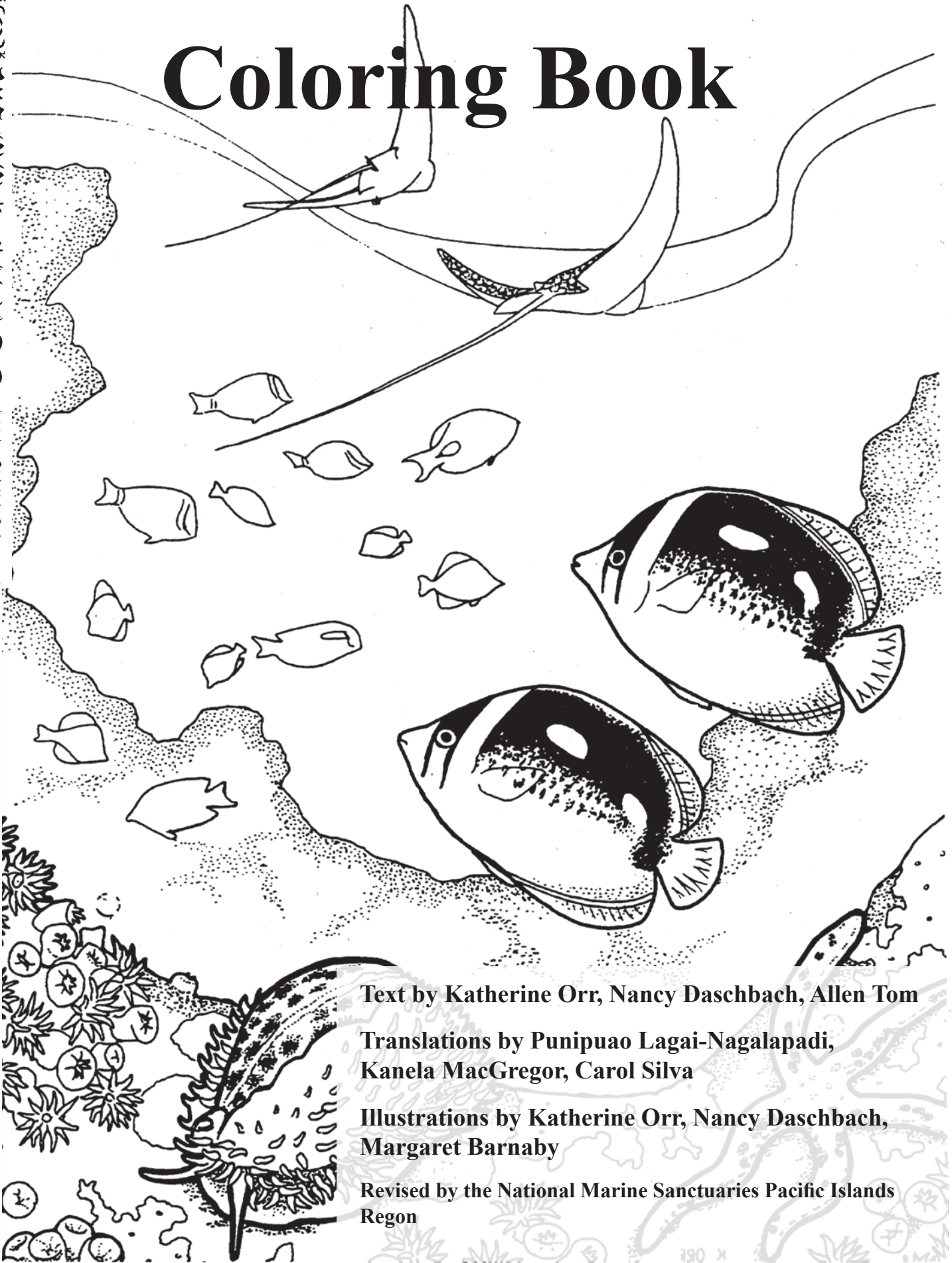


# Pacific Coral Reef Coloring Book



Text by Katherine Orr, Nancy Daschbach, Allen Tom

Translations by Punipua Lagai-Nagalapadi,  
Kanela MacGregor, Carol Silva

Illustrations by Katherine Orr, Nancy Daschbach,  
Margaret Barnaby

Revised by the National Marine Sanctuaries Pacific Islands  
Regon





# The Pacific Coral Reef Coloring Book<sup>®</sup>

Written by: Katherine Orr, Nancy Daschbach and Allen Tom

Illustrated by: Katherine Orr, Nancy Daschbach and Margaret Barnaby

Samoan Translation: Punipuaog Lagai-Nagalapadi

Hawaiian Translation: Kanela MacGregor, Carol Silva, with assistance from Claire Capelle

Layout and design by: Nancy Daschbach

Adapted from books by Katherine Orr

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*The blend of the Hawaiian and Samoan tapa design illustrates the underlying theme of this book: that the vast distances between islands in the Pacific are bridged by the cultures of the people and the natural resources of the coral reef. The Polynesian culture evolved in the world of the coral reef. Their appreciation of the life found in the reef ecosystem comes from millennia of dependence on the reef for their livelihood.*





## **Pacific Coral Reefs**

We who live in the Pacific—and those who visit here—are fortunate to be able to experience the amazing underwater world of coral reefs. Hawaii and American Samoa are among the most geographically isolated group of islands in the world. Evolution has produced animals and plants that are found nowhere else. Understanding and learning about them will help us to protect them. This coral coloring book was created to provide the reader with an introduction to the Pacific's fascinating coral reef ecosystem. For those of you who want to learn more about the South Pacific's unique underwater world, we encourage you to check out some of the outstanding marine fish and invertebrate books that are available in your bookstore or library.



*From a painting by Margaret Barnaby*

## Welcome to an underwater world!

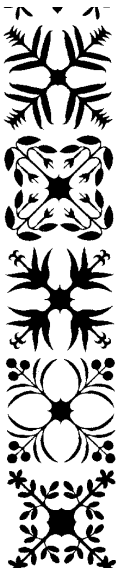
Coral reefs are among the most beautiful places in the world. If we visit a coral reef, using a facemask, a look box or looking through a glass-bottom boat, we see a strange and wonderful world. Corals of different shapes and sizes and colors grow here. Some look like rocks; others have bushy branches that stand firm in the currents.

Large coral reefs form masses of stony rock. They create food and shelter for other living creatures. Many kinds of plants and animals live on, around and within these coral boulders. Hundreds of colorful fish swim among the corals and hide in their shadows. Together all these forms of life make up the coral reef.

## Vaaiga i lalo o le sami!

O a'au o le sami e fa'atusatusa lea i le vaomatua ona o lona felanulanua'i ma lona matagofie. A tatou asiasi i a'au ma fa'aaoga mata fagota po'o se va'a e tioata lona pito i lalo, e mafa ona tatou molimauina le matagofie o meaola ese'ese o maua i o tatou a'au. O 'amu ua foliga ese'ese ma so'o se lanu e vaaia. E iai foi 'amu ua pei oni ma'a le malō, ao isi ua falala solo pei ni lālā o la'au.

O a'au amu o siosiomia ai motu ua faia lea ma mea e nonofo ai le tele o meaola o le sami ae maise foi le fa'aaogaina o 'amu e fai ma mea'ai a le tele o nei meaola. Ua tele ituaiga i'a felanuluanu'ai, o tamai meaola ma laau foi ua avea le a'au ma o latou lafitaga. O la nonofo fa'atasi o nei meaola uma fa'apei ose aiga e tasi ua maua ai a'au.



## E komo mai i kekahi honua kai hohonu!

Ho'ohana nā ko'akā i nā papa pōhaku nunui. Ho'oulu nā ko'akā i ka mea'ai a me nā halepale no nā meaola 'ē a 'e. Noho nā meakanu li'i a me nā holoholona iki ma luna, ma waena, a puni o kēia mau ko'a like'ole. 'O nā ko'akā nā wahi nani nō ho'i ma ka honua. Inā ho'okipa kākou i nā ko'akā, me kekahi makaanianikai, kekahi pahu nānā ai'ole ma kekahi mokupapaaniani, 'ike kākou i nā mea ano 'ē a kamaha'o. He mau kinona a me au na nui like'ole ko nā ko'a e ulu nei ma 'ane'i. Like kekahi me nā pōhaku; a like kekahi a'e me nā meakanu kūpa'a i nā au.

'Au'au a pe'e iho nā i'a waiho'olu'u ma nā aka. 'O ka hui pū 'ana o kēia mau mea apau ke kumu o nā ko'akā.



## What are corals?

Coral is built from the joined skeletons of tiny animals called “polyps”. Some polyps form their skeletons from a chemical called calcium carbonate. This is the same white substance that forms bones, seashells, chalk and our teeth. We call these hard or stony masses. Different hard corals are sometimes named after objects they resemble. Can you identify some corals: mushroom coral, the cauliflower coral, and finger coral?

Most coral polyps (1) are smaller than a pea. Their soft bodies look like little sacks with tentacles surrounding a mouth at the top. Each polyp is joined to its neighbor by its skeleton and an outer skin. A layer of slippery mucus protects the skin and helps some polyps catch their food. Polyps use their tentacles to capture bits of food that drift by. Special stinging cells in their tentacles paralyze the prey. Then the tentacles pass it to the polyp’s mouth.

## O a nei me o ‘amu?

O ‘amu o atiga ua fausia e le tele o meaola ninii e taua o polipo “*polyps*”. O nei meaola ninii e laititi ifo lava i le tamai pi lea e ‘ai. O le atigimalo o le polipo lea e taua e tatou o ‘amu, e fausia lea ini kemirale ua faaigoaina o “*calcium carbonate*” mai le sami. O le kemirale foi lea o faia ai o tatou ivi, nifo, atigi o figota faapea foi penesioka. O le vaega la o le ‘amu lea e vaaia e tatou e tusa o le pa‘u lena e pito i fafo. Ua faaigoaina ‘amu malō nei i mea e faafoliga i ai, e i ai ‘amu e foliga o le *mushroom* faapea, le *cauliflower* ma le ‘amu e foliga i tamailima.

O nei meaola ninii o polipo e galemulemu o latou tino ma foliga mai pei se ipu ti ae siosiomia le pito i luga ini ave taufelegele. O nei ave e faaaoga e le polipo e pueina ai ana mea‘ai, o ana mea‘ai e aafia ai mea o lo‘o ope‘opea ile sami. O ave o le polipo o lo‘o iai ni vailaau o‘ona e mafia ona faaumatia ai meaola pea tuia ai. A umu ona faaumatia meaola ninii mo mea‘ai a le polipo ona pasi lemu ifo lea agai i lalo i lona gutu ma le manava.

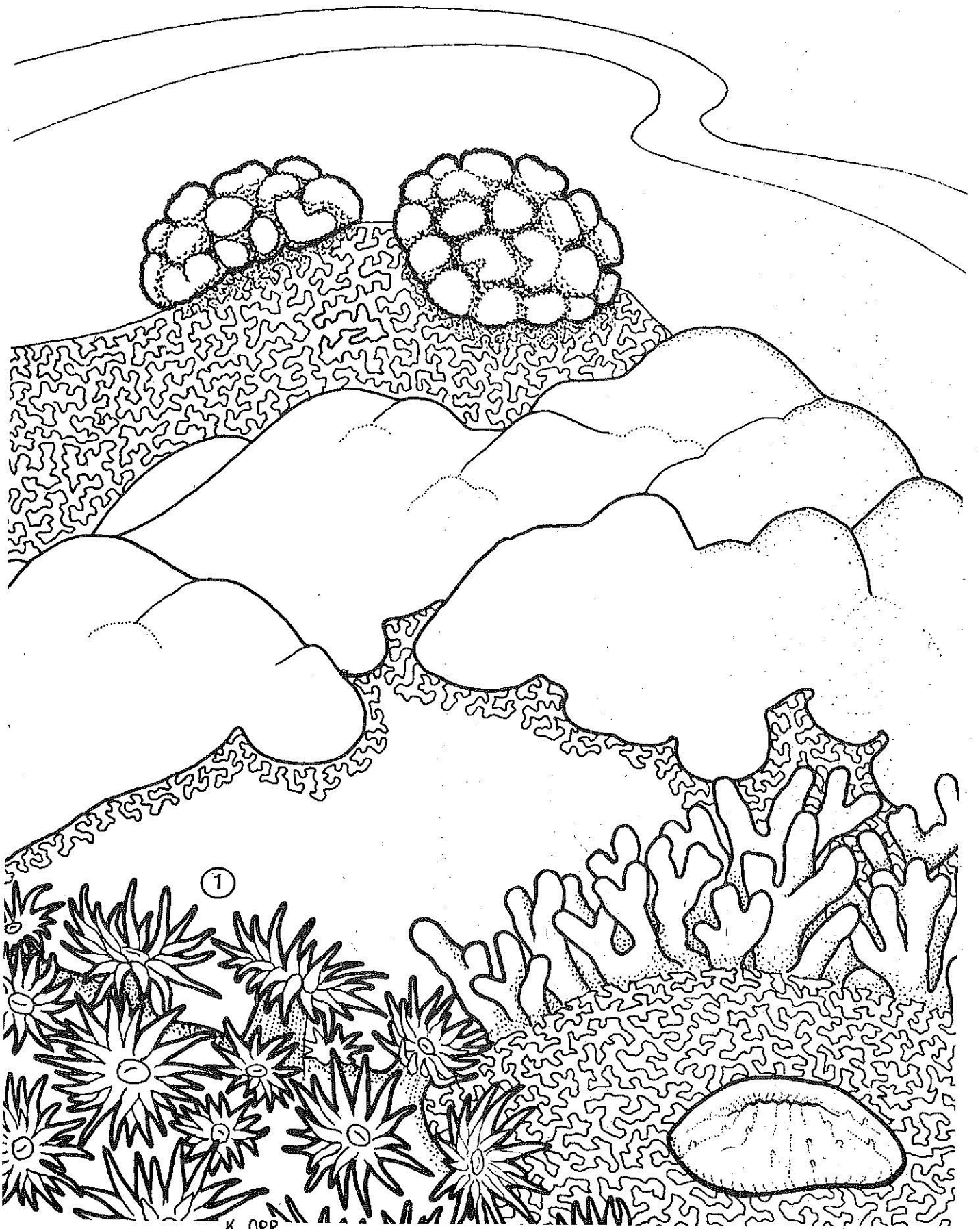


## He aha nā ko‘akā?

Ua ulu‘ia ke ko‘akā mai nā iwiami mai o nā holoholona iki kapa‘ia “uku ko‘ako‘a”. Ho‘okumu kekahi iwi mai kekahi kemikala mai kapa‘ia “*calcium carbonate*”. ‘O kēia ke kumukea like e hana nei i nā iwi, pūpu, poho, a me ko kākou mau niho. Kapa‘ia kākou i kēia nā papa pa‘a. Like nā inoa o nā ko‘apa‘a me nā mealike nō. Hiki iā ‘oe ke ‘ikepono i kekahi mau ko‘a: ko‘akohe (*mushroom coral*), ko‘a (*cauliflower coral*), a me ke ko‘a (*finger coral*)?

‘O i aku ka li‘i o ka hapanui o nā uku ko‘ako‘a ma mua o kā pāpapa. Ua like nā kino palupalu me nā ‘eke li‘i me kekahi mau ‘awe i ka‘apuni ai me kekahi waha i ka luna. Ua hui ‘ia nā uku ko‘ako‘a pākahi i nā hoa me nā iwi a me ka ‘ili ma waho. Ho‘opale a kōkua ka ‘ili he‘e i nā uku ko‘ako‘a e ki‘i ai i ka mea‘ai. Ho‘ohana nā uku ko‘ako‘a i nā ‘awe e ki‘i nā ma‘ai i lewa ai. Ho‘olōlō nā ‘awe i ka pio. A laila, ha‘awi aku nā ‘awe i ko ka uku ko‘ako‘a waha.





K ORR

### How do corals grow?

A single polyp builds a cup-shaped skeleton around its soft body. This polyp can multiply and eventually many polyps form a large mass of coral rock. In most corals, new polyps form by branching off from old polyps. They bud off from their parent much as a bud sprouts from the side of a tree.

As the polyps grow, they build new cup skeletons on top of the old ones. Polyps always grow at the surface of the colony. Below them, layer upon layer of old skeletons make up the coral rock.

If we cut through the coral rock, we see skeleton growth lines showing how the polyps grew and multiplied. The living surface of a hard coral can be green, pink, yellow, or even blue. But the coral rock inside is white (or in the unusual case of blue coral, the inside is blue) because only the living polyps have color.

### Faapefea ona o la ‘amu?

O polipo taitasi e fauina o latou atigi pito mai i fafo lea e vaaia e tatou ma taua o le ‘amu. O le atigi e faata‘amilomilo i le tino galemulemu o le ‘amu aua le puipuia o le polipo. E amata o tasi le polipo is se nofoaga ae mafai ona faateleina e ala lea i le tatupu ifo o tamai polipo mai le polipo tēlē faapei o tamai la‘au e tatupu ifo i le ‘aa o le la‘au tele. O le tele ma le tele o nei polipo e nonofo faatasi i koloni ma avea ai se nofoaga e tele ai ni ‘amu ma a‘au tele.

E vaaia le tutupu ifo o ‘amu fou i luga o ‘amu ua pēpē po ua foliga i maa. O le tele o ‘amu i o tatou a‘au ua pēpē ua na‘o se pito i luga o ola ai nai tamai ‘amu.

A tatou tata‘eina se oga‘amu, e mafai ai ona vaaia ai ni laina e iloa ai le tele o polipo na ola i totonu o se‘amu e tasi. Ua na‘o le vaega o le ‘amu o ola e mafai ona vaaie o lanu mai, e i ai lanu meamata, piniki, samasama, ma le lanu moana; ao le tele lava o ‘amu ua lanu papa‘e, o ‘amu ia ua pēpē.

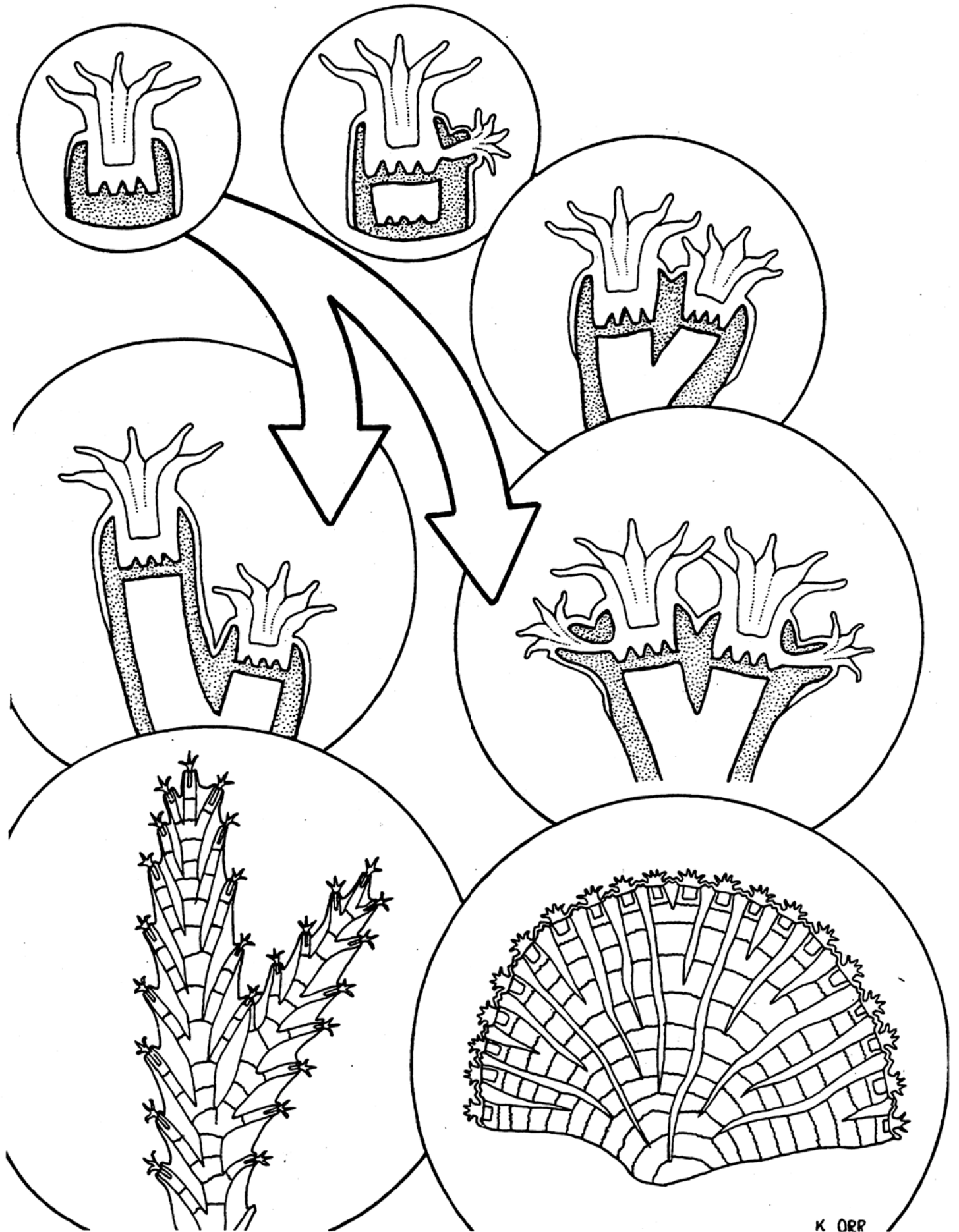


### Pehea e ulu ai ke ko‘a?

Kūkulu ho‘okahi uku ko‘ako‘a i kekahi iwi e like me ke kī‘aha a puni o kona kino palupalu. Ua hiki i kēia ke ho‘onuinui a ‘auane‘i ho‘okumu i kekahi papanui pūko‘a. Ua ho‘oula ka hapanui o na ko‘a mai nā uku ko‘ako‘a kahiko mai.

Ho‘okupu lākou mai ko lākou mau mākua mai e like me kekahi kumulā‘au.

I ka ulu‘ana o nā ko‘ako‘a, kūkula lākou i nā ‘iwi a‘apu hou ma luna o nā mea kahiko. Ulu mau nā uku ko‘ako‘a i mau ka papaluna o ka hui. Ma lalo, he papa ma he papa, ho‘ohana nā iwi kahiko i ke ko‘apa‘a. Inā kalai i ke ki‘apa‘a, ‘ike kākou i nā laina uluiwi e hē‘ike nei i ka ulu ana o nā uku ko‘ako‘a. Ua hiki i ka papaola o ke ko‘a e loa‘a i ka ‘ōma‘oma‘o, ‘ākala, lenalena, ai‘ole uliuli. Akā ua kea ka loko (koe na‘e ke ko‘a uliuli) no ka mea ua loa‘a i nā ko‘aola ka wai—ho‘olu‘u wale nō.





### How are reefs formed?

From time to time polyps produce eggs and sperm. These join to form a baby coral animal called a planula (1), which drifts in the sea. If the planula finds a clean, hard surface, it attaches itself and turns into a polyp (2). The polyp grows and multiplies by budding (3). In this way, corals spread from one place to another.

Dead coral rock provides a hard surface where planula can settle, but many other creatures settle there, too. Often plants and sponges cover the surface before new polyps can attach—or plants may grow over young polyps and smother them. Reef animals such as sea urchins, parrotfish, snails and limpets graze on the plants and sponges, making room for new corals to settle and grow. Most corals grow about one centimeter per year, so it takes hundreds of years for a coral reef to develop (4). Without the help of animals that feed on fast-growing plants, a reef could never develop.

### E faapefea ona fausia a‘au?

O tamai meaola ia e fausia ‘amu e tatau lava ona tuufaatasia vaega tane ma fafine e faia ai le tamai ‘amu. O lea tu‘ufaatasiga e masani lava ona tupu pe tasi lava i le tausaga. O le foliga mai o lenei faatasiga e faapei o le taimi lea e sau ai i luga le palolo. O tamai ‘amu e ope‘opea ma avesolo e galu i ogasami ese‘ese. A maua se ogasami māmā ma mafai ona pipiimau ai lenei tamai ‘amu ona aveia lea ma polipo. E tupu ma olaola polipo, ma faateleina i nei nofoaga e o‘o lava ina salalau ma tele lava ‘amu i nofoaga ese‘ese o le a‘au.

O ‘amu ua pēpē e aogā i polipo nei ao tau tuputupu ae, o le tele foi o isi meaola ole sami e lalafi ma nonofo i pūpū o ma‘a nei. O luga o le a‘au ua ola ai limu ma omomi ma ufitia ai le tele o nofoaga, o nofoaga ia e mafai ona ola ai ‘amu. O isis nofoaga ua tutupu ai limu i luga o tamai ‘amu o tuputupu ifo ma o‘oi ina pēpē ai. O meaola o le a‘au e iai kuikui/vaga/sāva‘i, le i‘a o le fuga, o sisi ma alili e latou fesoasoani tele i le faamāmāina lea o limu ma omomi o ola i luga o le a‘au ina ia avanoa le mea e ola ai ‘amu.

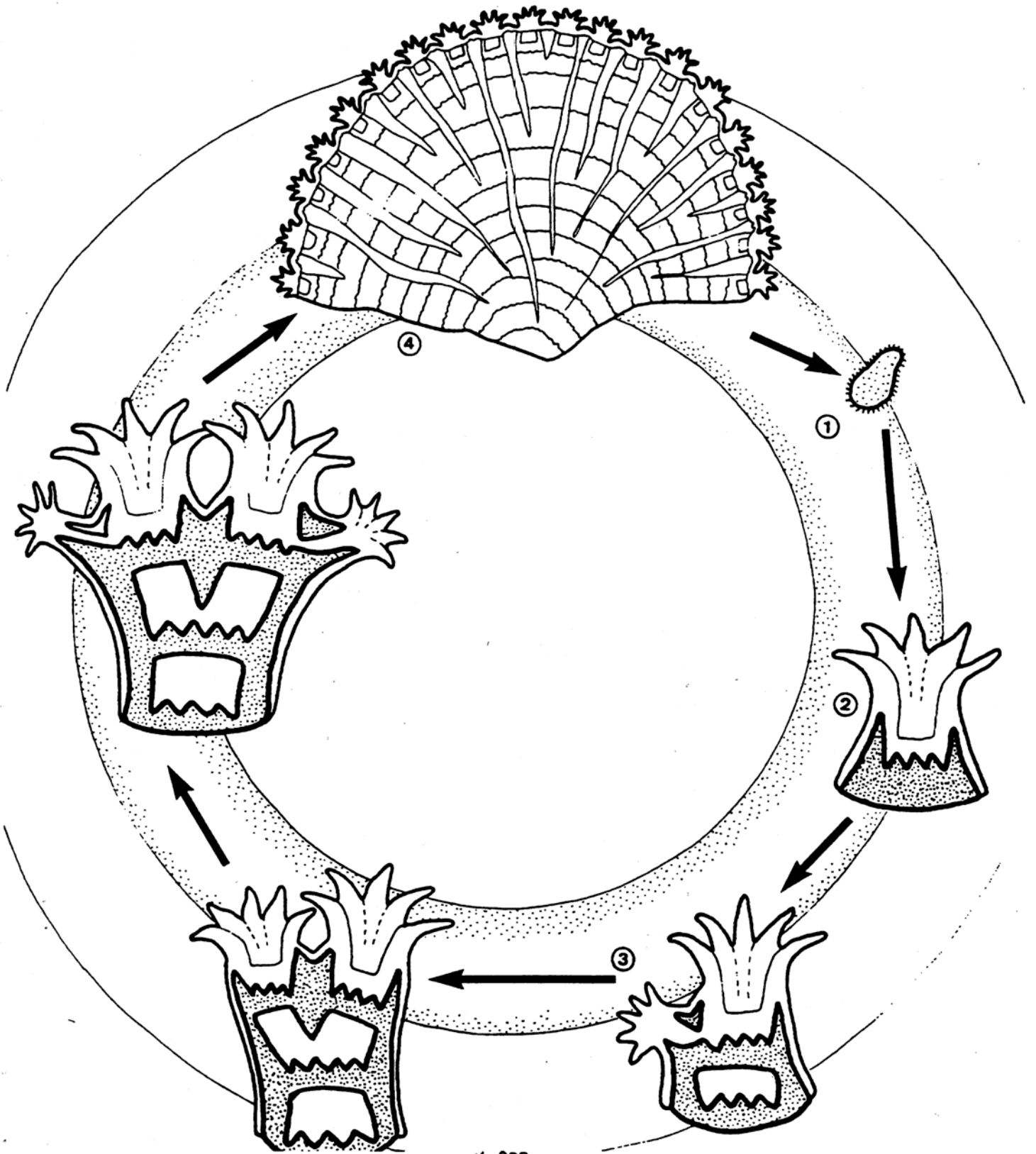
E telegese foi le tuputupu ‘ae o ‘amu, e tusa pe tasi le senitemita e tupu ai le ‘amu ile tausaga e tasi. O le tulaga foi lea e faitau selau ai tasaga o tau fausia se a‘au ‘amu. O le a‘au e manaomia tele le fesoasoani le isi meaola i le isi aua le olaola lelei pea oi latou faapea tatou foi.



### Pehea e kūkulu ai nā ko‘akā?

I kekahi manawa, ho‘ohana nā uku ko‘ako‘a i nā hua a me nā keakea. Ho‘ohui kēia e hānau i kekahi ko‘a keiki e lanawale ai ma ke kai. Inā huli ke keiki i kekahi papa pa‘a a pono, ho‘ohui ia a lilo i uku ko‘ako‘a. Ho‘onuinui ka uku ko‘ako‘a. A pēia, ho‘oka‘awale a laha i kēia wahi me kēlā.

Ho‘okumu ke ko‘a hala i kekahi papapa‘a no ka noho‘ana o nā ko‘a keiki a me nā mea iki a‘e. Ho‘opo‘i pinepine nā meakanu a me nā ‘ūpī i ka papaluna ma mua o ka hui pū ‘ana o nā uku, ko‘ako‘a hou. Ai‘ole ulu nā meakanu ma luna o nā ko‘a ‘ōpiopio a ho‘ohala iā lākou. ‘Ai ka wana, ka uhu, ke alili, a i ka ‘ōpihi, ma nā meakanu a me nā ‘ūpī e ho‘oho‘onui i na wahi no ka ulu‘ana o nā ko‘a hou. Ulu akula ka hapanui o na ko‘a i ho‘okahi kenimika na pākahi i ka makahiki, no laila, ke pau ka ulu‘ana ma hope o nā makahiki hāneli nui. Ina, ‘alole kokua nā holoholona ‘ai meakanu ukuwiki, ‘a‘ole hiki i nā ko‘akā ke ho‘onuinui.



K ORR

### Where are coral reefs found?

Coral reefs grow in seas with warm, clear, and fairly shallow waters. Such waters are most often found on eastern shores of continents, around small islands, and in open tropical seas.

Reef-building corals need these conditions because tiny, single-celled plants live within the polyps. Without these tiny plants, called algae (zooxanthellae), corals do not make enough skeleton to build reefs. Algae need sunlight, so the water must be clear and shallow enough for light to reach the plants.

The coral polyps, and the plants within them, help each other. The polyps provide wastes that act as food for the plants. The plants, in turn, make oxygen and food for the polyps.

### O fea e maua ai a'au 'amu?

O a'au 'amu e ola i ogasami mafanafana, māmā, ma papau. O nei ogasami e maua i gatai o itu i sasae o konitineta, e faataamilomilo i taamai nu'u, faapea foi sami mafanafana.

O tamai la'au nini'i o se tasi o ituaiga limu e nonofo faatasi ma polipo i totonu o le tino o le 'amu. O lenei ituaiga limu e galulue faatasi ma le polipo i le fauina o le 'amu ae maise le a'au, e tatau ona ola i ogasami māmā ma papau. O ia tamai limu (*zooxanthellae*) e fesoasoani i le fauina o 'amu. O laau uma e i ai limu e tatau lava ona mauaina le susulu o le la ina ia mafai ona ola lelei ma faia ai ana mea'ai. E aogā tele le nonofo o polipo po'o meaola nini'i ia e fauina le 'amu faatasi ma limu nini'i nei e fesoasoani i ai. O limu foi nei e ala ai ona lanu ese'ese le 'amu. O polipo e maua ai mea'ai a le limu, a'o limu e faia mea'ai a le polipo ma maua mai ai lei okesene e ola ai nei meaola.



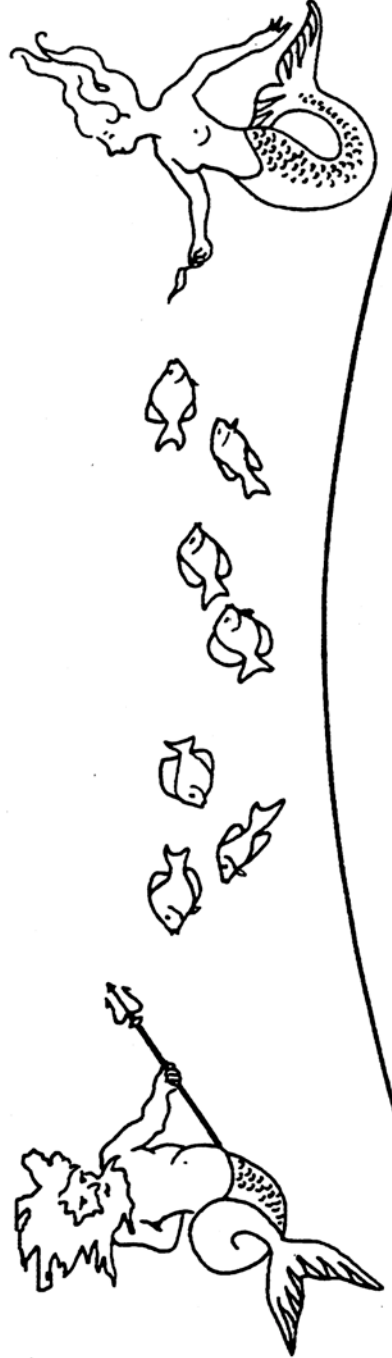
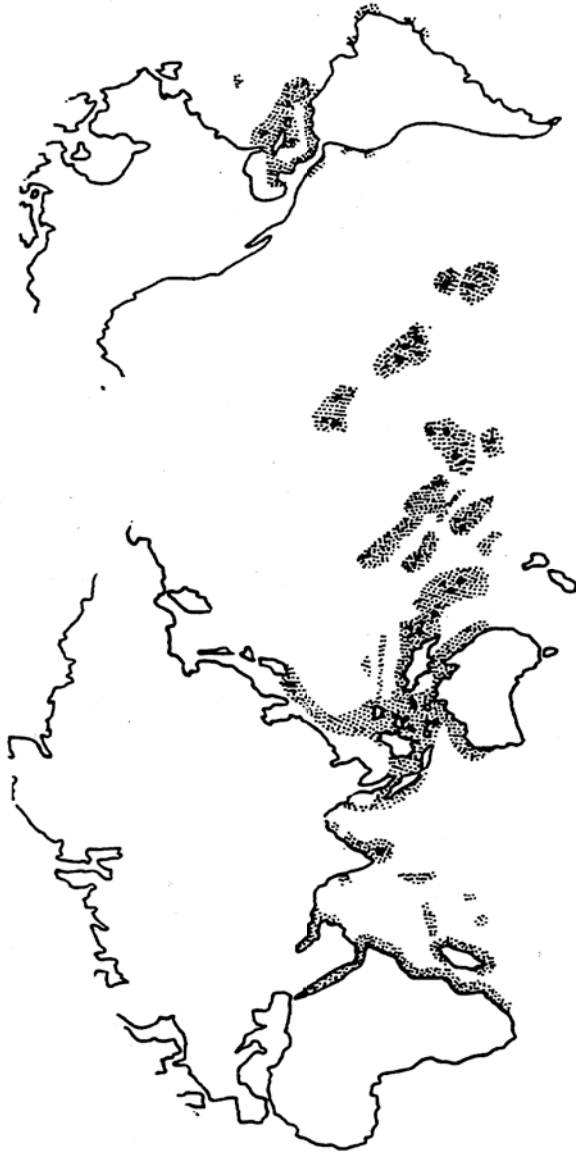
### 'Auhea a loa'a ana i nā ko 'akā?

Ulu nā ko'akā i nā kai mehana, moākaka, a ano pāpa'u. Ua loa'a kēia mau moana ma nā 'ao'ao hikina o na 'aina, a puni o nā mokupuni, a i moana.

Pono nā ko'a kūkulu ko'akā e noho ma kēia ano no ka mea noho nā meakanu lumihāiki ho'okahi ma laila. Ina, 'a'ole kei mau meakanu kapa ia "algae", 'a'ole, kūkulu nā ko'a i nā iwi he lawa. He mea pono ka lā no ka "algae" no laila, pono ke kai e noho moākaka a pāpa'u no ke la'i 'ana o na meakanu i ke ao.

Kōkua nā 'āpana ko'a i kekahi i kekahi. 'O ka hahalepo o nā 'uku ko'ako'a ka mea'ai no nā meakanu. A hānai ea nā meakanu no nā 'uku ko'ako'a.

# Coral Reefs of the World



K. ORR.

### Biogeography: how do reefs differ?

Reefs are found all over the tropical world. Not all reefs are alike, though. The reefs with the most biodiversity, or different types of plants and animals, are found in the far western Pacific and southeast Asia. As reefs occur farther and farther from this rich “center”, numbers of different organisms go down.

There are about 1,000 species of fish in American Samoa (as opposed to 2,000 in Australia), and less than 500 in Hawai‘i. Corals, too, are fewer as you get farther east. In Samoa, there are about 200 species, but in Hawai‘i, which sits isolated in the northern hemisphere, there are only about 50 species. Atlantic reefs have even lower diversity compared to Pacific reefs.

Why? There are many reasons. Small island ecosystems cannot support the great diversity that a larger area, such as Australia Great Barrier Reef, can. Also, the huge distances between islands means that fewer plants and animals survive the long ocean journeys that allow them to colonize remote islands. Can you think of other reasons?

### Ese‘ese o a‘au?

O a‘au e maua i itu vevela ole lalolagi, e ui lava ina ‘ese‘ese ituaiga a‘au. Ole itu i Sisifo ole Pasefika ma Saute Sasae o Asia, o ogasami ia e pito i sili ona tele ai ituaiga meaola ma laau ese‘ese o maua ai. O le mamao ese o a‘au mai ia ogasami o le faaiti‘itia foi lea o le tele o meaola ese‘ese o maua ai.

E tusa ma le tasi le afe (1,000) ituaiga i‘a o loo maua i Amerika Samoa (e fatusatusa ma le 2,000 o lo‘o maua i Ausetalia), ae tusa e 500 ituaiga i‘a i Hawai‘i. I Amerika Samoa, e tusa ma le 200 ituaiga ‘amu o lo‘o maua ai, ae tusa ma le 50 ituaiga i Hawai‘i. O ese foi ituaiga a‘au o maua i le sami o Atalani ma laititi lava ituaiga meaola ese‘ese o maua ai. Pe aisea? E tele mafua‘aga. E le mafai e motu laiti ono sapaapaia le tele o meaola eseese e pei ona maua i nofoaga telele e i ai a‘au tele i Ausetalia. O le vāvā mamao o motu ua le mafai ai ona feaveai meaola mai le isi motu i le isi. Pe ete oloa nisi mafua‘aga?

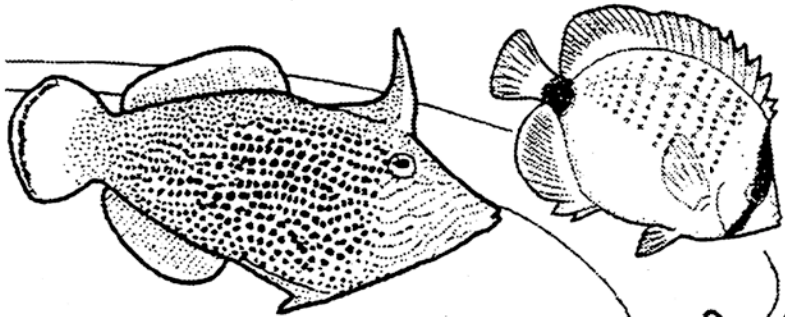


### Nā me ‘oko‘a ma waena o nā ko‘akā like ‘ole?

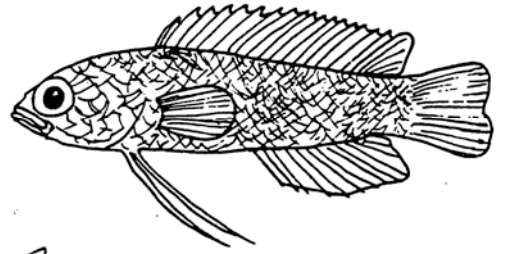
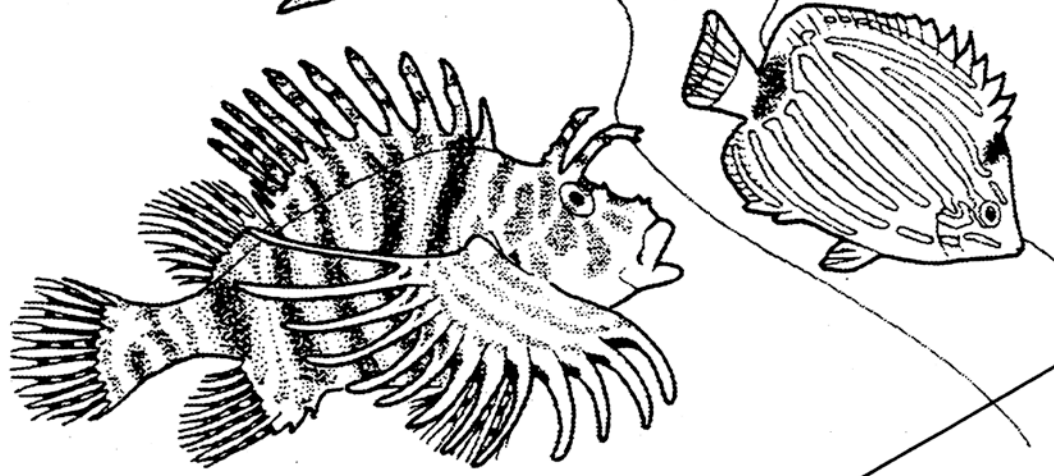
Loa‘a nā ko‘akā ma ka honua holo‘oko‘a. Akā, like‘ole nā ko‘akā. Loa‘a nā ko‘akā like‘ole i ka Pakipika komohana mamao a me Asia hemi-hikina. I ka hele ‘ana akula mai kēia “piko” mai, emi ‘ia nā mea ‘oko‘a.

Aia ho‘okahi kaukini ano i‘a ma Samoa Amelika (like‘ole me 2,000 ma Australia) e emi iho 500 ma Hawai‘i nei. Ho‘emi‘ia nā ano ko‘a pū mai ka hikina aku. Ma Samoa aia ea ‘ano o 200 ‘oi a emi mai, akā i Hawai‘i, ma ka ‘ao‘ao ‘akau, aia aa ‘ano 50. Ua ‘oi aku ka like ‘ole o nā nā ko‘akā Atenalika ma mua o nā Pakipika.

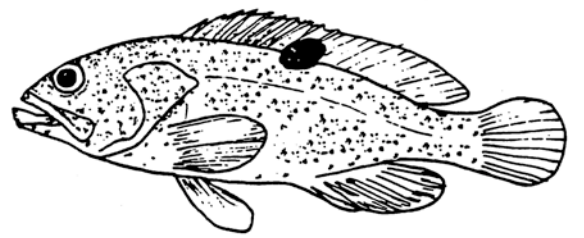
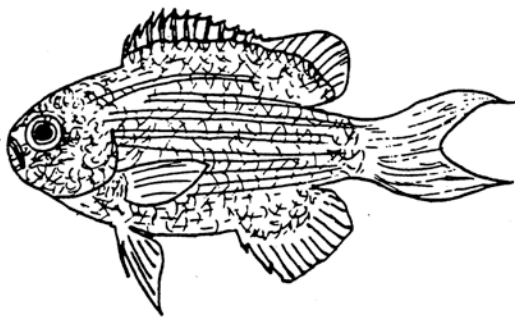
No ke aha lā? Ua nui nā kumu. ‘A‘ole hiki i nā mokupuni iki ke kāko‘o i nā mea like ‘ole e like me kekahi wahi nunui ‘oia ho‘i‘o “Australia Great Barrier Reef”. A me nā mile nunui ma waena o nā mokupuni, no‘emi ‘io ka helu o nā mea me ka ‘ikaika lawa e ho‘ola i na holo ‘ana ma ka moana.



Fishes found only in Hawai`i



Fishes found in Samoa and other western Pacific reefs



## How do plants help build coral reefs?

Most sea plants are referred to as algae. Some algae form skeletons of calcium carbonate, just like corals do. These plants, called coralline algae, are important builders of Pacific reefs. Some form pink, brown or red crusts, while others grow in small branching clumps. Together with the crumbled shells of reef animals, their skeletons create sand grains, which fill in the cracks and holes between the corals. Some grow living crusts across the rock, which help protect the reef from wave action. Others grow among loose coral rubble and cement it together into solid reef.

Perhaps the most important reef building algae are very small single-celled organisms called “zooxanthellae”. They live within the tissues of reef building coral polyps and are too tiny for us to see with the naked eye. Without these algae, coral reefs could not develop, because the corals could not grow well enough or make enough skeletal material to build reefs. Zooxanthellae use sunlight to make oxygen and food, which the polyps use. The polyps produce wastes that the zooxanthellae need. Thus, these algae and animals help each other to survive, and together they enable a coral reef to grow.

### Fesoasoani i la‘au ile fausiaina o a‘au?

O le tele o la‘au o le sami ua faaigoaina o limu. O isi ituaiga limu latou te fausia o latou atigi malō e pei lava o ‘amu. O limu nei ua faaigoaina o *coralline algae* e tāua mo le fausia o a‘au ole Pasifika. O limu ia e iai o latou pau ua lanu piniki, lanu enaena, ma lanu mumu. O le faaputuga o atigi nuti o meaola ole a‘au e gaosiaina ma potoi oneone o lo‘o faatumuina pūpū o le a‘au. O isi laau o lo‘o feola i luga o ma‘a e puipuia ai le ‘aau mai galu malolosi, ao isi e ola faatasi ma maamaa o le a‘au.

O la‘au e pito sili ona taua i le fauina o a‘au, ua faaigoaina ia limu o *zooxanthellae*. O limu nini‘i nei e le mafai ona vaaia i o tatou mata, e nonofo faatasi i totonu o le totino o le ‘amu ma tamai meaola o polipo. E galulue faatasi nei meaola ma limu i le fauina o le a‘au. O nei ituaiga limu e faaogaina le susulu o le la e fai ai mae‘ai ma okesene mo le polipo. A‘o toeaiga po‘o mea lafoai a le polipo e fai ma mea‘ai a limu. O le nonofo faatasi o polipo ma limu o se tulaga taua tele lea i le faaolaina ma tuputupu ose a‘au ‘amu.

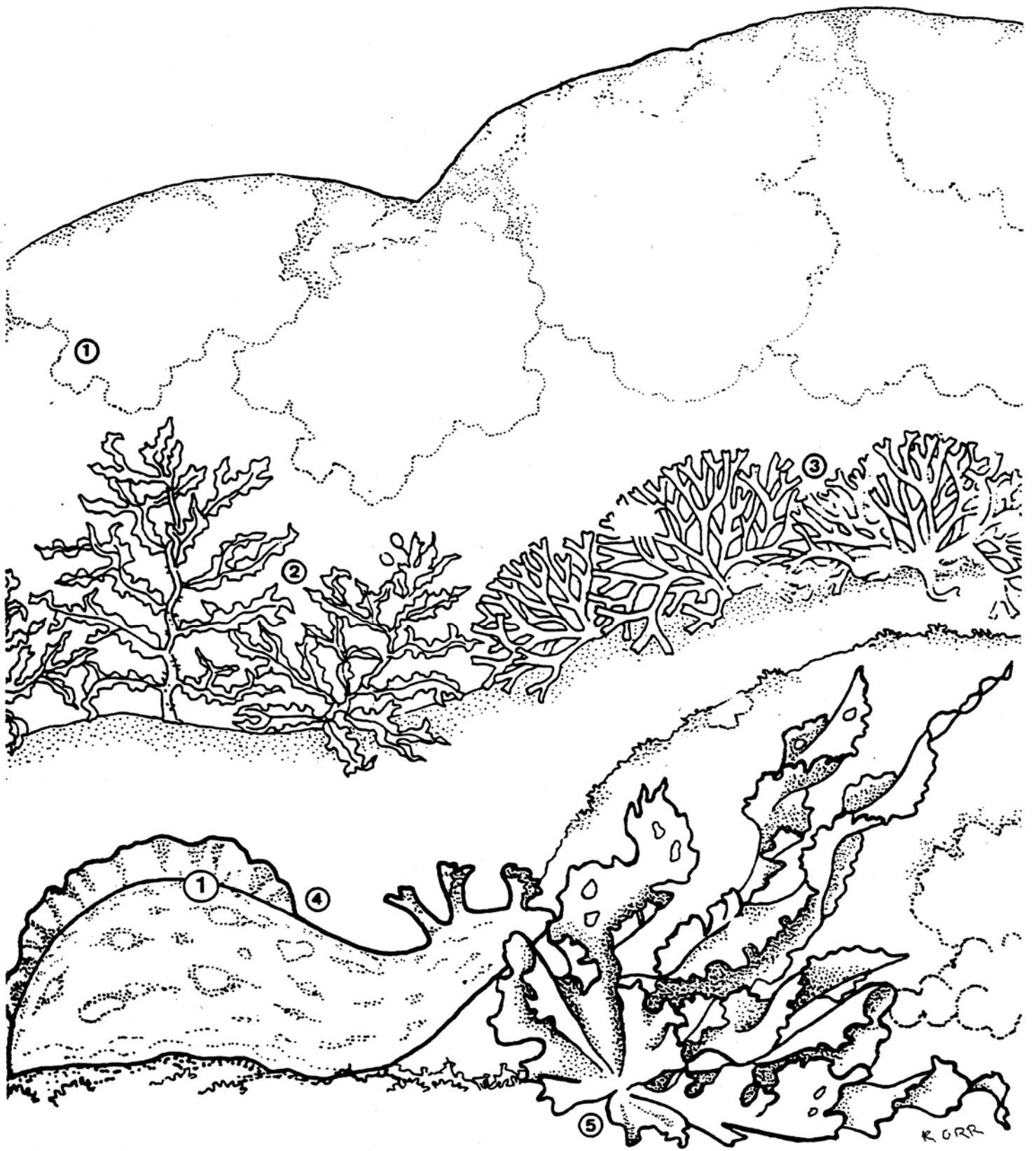


### Pehea nā la ‘au e kōkua ‘ana me ke kūkulu ‘ana o ke ko‘akā?

Ua kapa ia ka hapanui o nā meakanu, “na limu”. Ho‘okūkulu kekahi mau limu i nā iwi o *calcium*, e like me ke ko‘a. He mea nui kēia mau ano. He mau ‘apana ‘ākala, māku‘e, ‘ula‘ula kekahi, a he mau pu‘u li‘i ko nā mea ‘ē a‘e. ‘O ka hui pū‘ana o nā mea iwi li‘i nā mea e ho‘opiha ai i na puka ma waena o nā ko‘a. Ho‘opale kekahi i ke ko‘akā i nā nalu. A ulu a‘e kekahi me nā ko‘a a ho‘opa‘a ia.

‘O ia paha ka mea nui no ke kūkulu‘ana, kekahi limu lumikahi kapa ‘ia “*zooxanthellae*”. Noho ma ke kele o nā ‘uku ko‘ako‘a a ‘a‘ole hiki ke ‘ike me kou maka wale nō. Ina ‘a‘ole kēia, ‘a‘ole hiki i nā ko‘akā ke ulu a‘ele, no ka mea ‘a‘ole hiki i nā ko‘a ke ho‘oulu i nā iwipa‘a. Ho‘ohana ka “*zooxanthellae*” i ka lā e hana i ka ‘ea a me ka mea ‘ai no nā ukuko‘ako‘a a laila ho‘onana i kā nā ukuko‘ako‘a kūkae, e peia, kōkua nā meakanu kekahi i kekahi e ho‘oulu i nā ko ‘akā.





K ORR

### Pacific reef members: attached animals

Many coral reef animals drift when they are young, but soon settle down to live attached to the reef. Because they cannot move around to find food, most capture or filter bits of drifting food from the water.

Octocorals (1, 5)—colonies of polyps with eight tentacles—grow in encrusting and branching forms. Their relatives, the hydroids (4), form colonies that may look like tiny ferns or feathers. Hydroids grow on the reef and on pier pilings and docks in harbors. Watch out for their painful sting!

Sponges (2) come in many shapes and colors. Their porous tissues are often homes for small worms and shrimps.

Sea squirts, or tunicates (3), live alone or in colonies. Although sponges and tunicates aren't related (tunicates are vertebrates—like us), they both pump water through their bodies and strain out food.

Sea anemones (6) are coral relatives. They attach themselves to the bottom by a muscular foot. The hermit crab anemones get to travel because they live on old snail shells inhabited by hermit crabs.

The Christmas tree worm (7) lives hidden in a tube within living lobe coral. Its bright feathery tentacles vanish instantly when startled.

The spaghetti worm (8) lives hidden from view except for long white tentacles spread across the bottom to gather food from the sediment.

### O meaola nofomau i le taele o le a'au

O le tele meaola ole a'au e amata o latou olaga i le opeopea i le sami. E le umi se taimi ona maua lea o se nofoaga i le a'au e pipii ma nofo tumau ai i lona olaga atoa. O le 'amu o le tasi lea o nei meaola. A maua loa se nofoaga tumau ona le mafai lava lea ona toe fealua'i pe sui foi sona nofoaga i luga o le a'au. O le tulaga lea e tatau ai ona latou faaagaina o latou ave felefele e pue ai mea'ai o lo'o opeopea ile sami.

Amuvalu (1, 5)—o polipo e nonofo i koloni, o 'amu e valu ona ave felefele—e tupu maa'a ma lālā solo. O isi meaola e nonofo i kiloni e foliga mai o tamai fulu poo oli'oli ua faaigoa o *hydroids*. O *hydroid* e ola ile a'au faapea lalo o nofoaga e taula ai vaa po'o uafu ma afai e tuia ai oe e matua tigā lava.

O omomi (2) e maua i soo se ituatga lanu ma foliga ese'ese. O le vava o latou tino e avea lea ma lafitaga mo anufe ma tamai ula.

O *tunicates* (3) isi meaola e nonofo taitasi pe koloni foi. O *tunicate* ma omomi e mafai ona faaalu i totonu vai ma toe faasau i fafo ae pueina ai a latou mea'ai.

O lumane (6) e i le aiga o meaola ma 'amu. E masani ona pipii i nei meaola i le pito i lalo o vaa. O isi ituaiga lumane e pipii i luga o atigi o paa.

(7) O anufe sami ua faaigoaina o le anufe laau Kerisimasi e lafi i totonu o le tino o 'amu. A tago i ai e faafuasei ona faanunumi ona ave fulu.

Ao le anufe supakeli (8) e le vaايا se vagana ai ona ave papae e felefele solo mai i fafo au'a le sueina o ana mea'ai.



### Na mea ko'akā Pakipika: na holoholona pa'a'ia

Lanaweke ka hapanui o nā holoholona ko'akā i ka wā 'ōpio, akā ho'opa'a koke laka i ke ko'akā. 'A'ole hiki iā lākou ke ne'e a'e, no laila, hopu i ka mea'ai i ke kai.

Ko'awalu (1, 5)—nā hui o na 'uku ko'ako'a me 'ewalu 'awe—ulu ia e like me nā lā'au. Ma ka 'ohana, nā *hydroids*, ho'oulu nā hui e like me nā hulu ai'ole nā pala iki. Ulu nā *hydroids* ma ke ko'akā ai'ole ma nā lā'aukū ma ke awa. E akahēle i ke kiki eha!

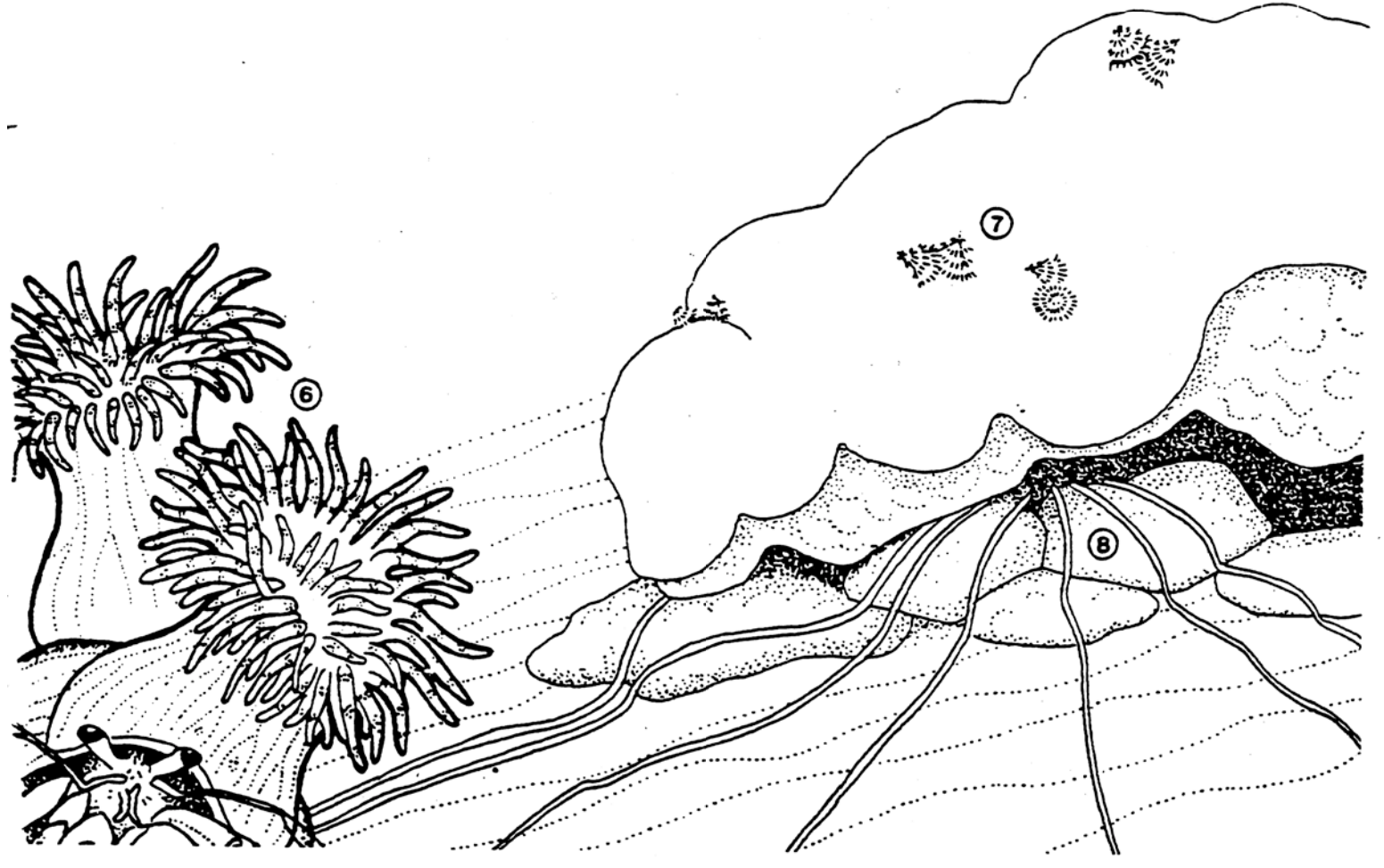
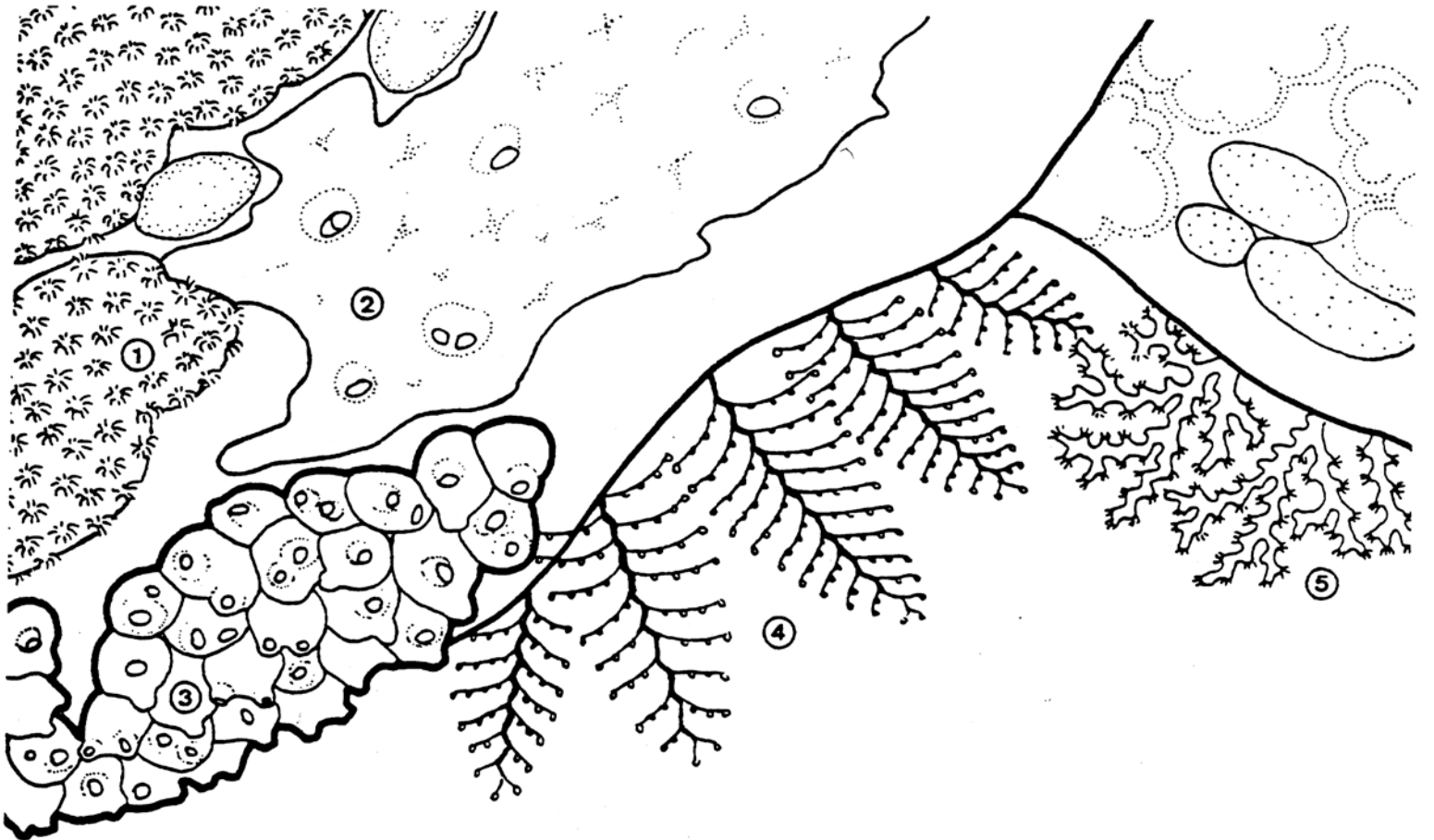
(2) Nui nā kino a me nā waiho'olu'u like'ole o nā 'ūpī. He mau hale nā i'o pukapuka no nā "ko'e" a me nā 'opae.

(3) Noho ho'okahi wale nā *tunicates*, ai'ole nono laka i nā hui. 'A'ole he 'ohana ka 'ūpi a me ka *tunicate* akā ho'opahu nā mea 'elua i ka wai ma loko o ko lākou mau kino a kanana i ka mea'ai.

(6) He'ohana ko'a nā 'ōkole emiemi. Ho'opa'a lākou i ka lalo me kekahi lala i'o. Ua hiki i nā 'okole'i emiemi papa'i ke ho'omāka'ika'i no ka mea noho lākou ma nā pūpū haka.

Noho pe'e ke ko'eko'e kumulā'au Kalikimaka (7) ma kekahi 'ohe ma loko o ke ko'a ola. Pe'e iho nā 'awa hulu i ka ho'opū'iwa'ana.

Noho pe'e ke ko'eko'e kino *spaghetti* koe (8) na'e nā 'awe lē'ihikea ma ka lalo o ka lepo no ka 'ohi'ana i ka mea'ai.



### **Pacific reef members: creepers and crawlers**

Most of the reef’s creeping and crawling members rest hidden within caves and crevices during the day and come out at night to feed.

The triton’s trumpet snail (1) is active at night, hunting one of its favorite foods—the crown of thorns seastar.

Both the crown of thorns seastar (2) and all long-spined sea urchins (3) have poisonous spines and should not be touched. The crown of thorns feeds on coral polyps, while long-spined sea urchins feed on algae.

The black sea cucumber (4) lives in the open on sandy patches within the reef, sorting through the sand for bits of food. Its cousin, the light-spotted sea cucumber (5), lives under rocks, but stretches its long body out into the open to feed at night.

Most hermit crabs (7), along with their relatives the lobsters (6), shelter by day and are active at night. Hermit crabs live within empty snail shells. As the crab grows, they must find larger shells to move into.

### **Meaola tolotolo ma sosolo o le a’au**

O le tele o meaola tolotolo solo ile a’au e momoe ile ao ae feoa’i ile po mo le sueina o a latou mea’ia.

O le sisi tēlē (1) lea e ili faapu e tagata e fealuai foi i le po aua le sueina o ana mea’ai masani o le alamea.

O vana (3) ma alamea (2) o ni meaola ia o le a’au e talatala o latou ave ma o’ona pea tuia ai se isi. O vana e ‘aiina limu ao alamea e ‘aiina amu.

O loli (4) e nofo i luga ole oneone ma suasuaina le oneone e maua ai ana mea’ai.

O sea (5) e nofo i lalo o ma’a ae sue ana mea’ai ile po.

O pa’a uga (7) ma ula (6) e lalafi ile ao ae feoa’i ile p. O le uga e sueina atigi ua leai ni sisi o nofo ai ona fai lea mo a latou fale seia o’o foi ina ia le toe ofi i totonu ona toe sue foi lea o le isi atigi tele atu.



### **Na mea ko’aka Pakipika: nā mea kolo**

Ho’omaha pe’e ka hapanui o nā mea kolo ma loko o nā pao a me na naele ma ka lā a ho’opuka i ka pē no ka ‘ai’ana.

Ua maka’ala ka pū puhi ma ka pē, a hāhai ‘o ia i kona mea’ai punahele—ka ‘alamea.

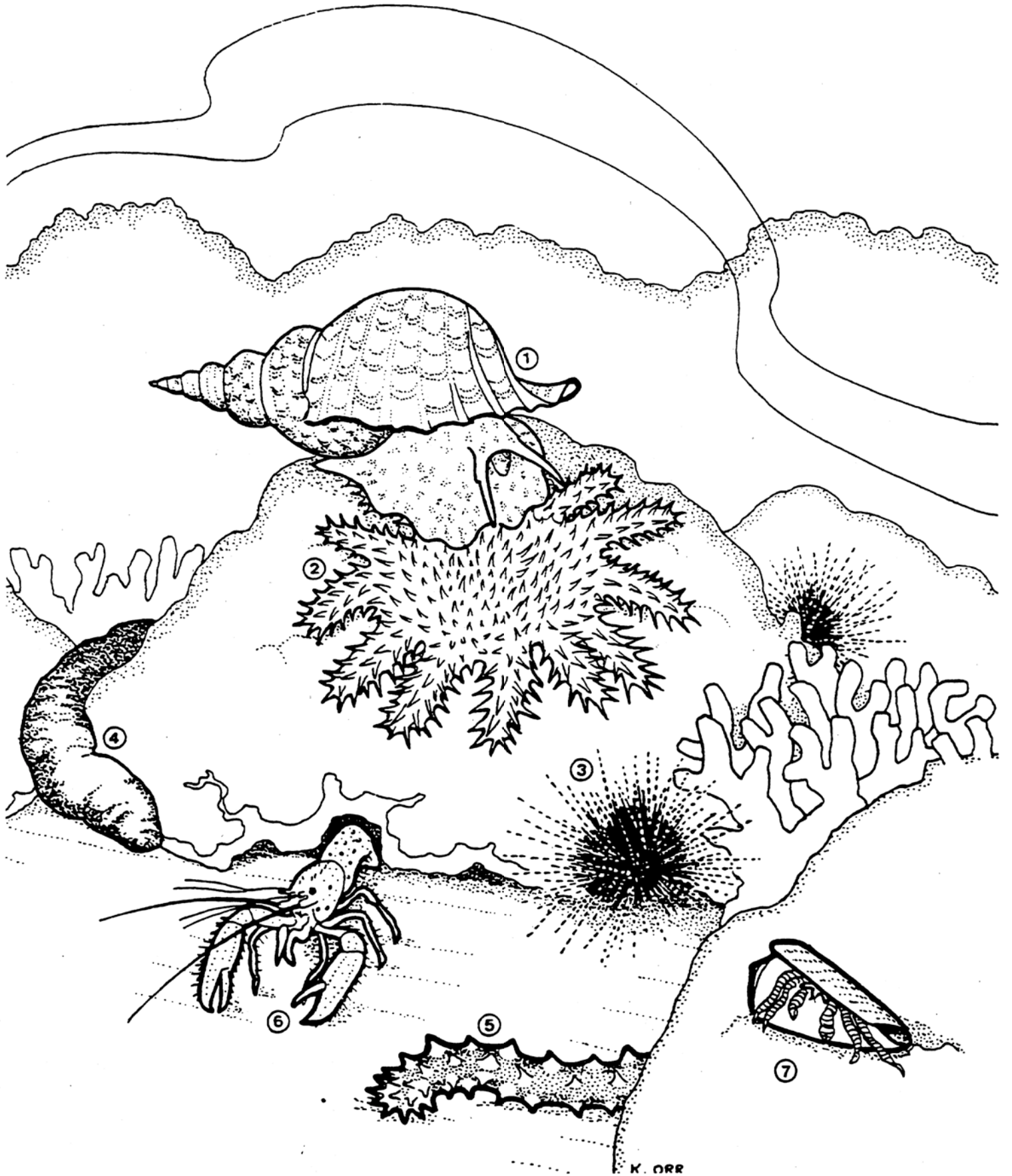
He mau wanawana ‘ino ko nā ‘alamea a me ka wana, no laila ‘a’ole ia e ho’opa’a ai. ‘Ai ka ‘alamea i nā uku ko’ako’a, a ‘ai nā wana i ka limu.

Noho ka loli i nā wahi one ma ke ko’a ka, a ‘imi i ka mea’ai i ke one. Noho kona hoahānau ma lalo o nā pōhaku, akā, ho’opuka ‘o ia i ka pō, no ka ‘ai ‘ana.

Ua maka’ala nā pāpa’i a me nā ula i ka pō a noho mālie i ka lā.

Noho nā pāpa’i i nā pūpū haka. I ko lākou ulu’ana, pono e huli i nā pūpū nui a’e.





K. ORR

### **Pacific reef members: the swimmers**

Coral reef fish vary widely in shape, color, size and behavior. Some travel long distances, while others stay within a limited reef area.

Blue jacks are strong swimmers. They do not shelter in the reef, but may visit to hunt small fish for food. Some butterflyfish, by contrast, may spend their whole lives near a single clump of coral.

A school of damselfish swims above the coral, feeding on plankton, while a large scorpionfish sits motionless on a rock. It actually looks like part of the rock as it waits to catch small fish that swim near.

A school of goatfish swims close to the bottom, where they run their barbels through the sand in search of food. They pass a whitetip reef shark resting in a coral cave after its lobster dinner.

### **A‘au o le Pasifika ma ona i‘a**

O i‘a ole a‘au e ese‘ese uma lava, e amata mai i o latou foliga po‘o faitino, o lanu, aemaise a latou amioga. O isi i‘a e malaga mamao mai le a‘au ao isi e nofonofo latalata lava i lona fasipito i luga o le a‘au.

O malau/ulua o tasi ia o i‘a e malosi e fealua‘i i le sami, e ui‘ina le nofo tumau ia nofoaga e tasi i le a‘au ae vaaia o su‘e mea‘ai i luga o le a‘au. O i‘a e iai tifitifi, e nonofo latalata i faaputuga ‘amu i o latou olaga atoa ma puipuia lea nofoaga pei o lana lava mea totino.

O mamo e feoai lava i luga ifo o ‘amu ma a‘ai i tamai meaola ninii o opeopea i le sami, ao mutu e sasao lelei lava i luga o ma‘a poo ‘amu e faatalitali ai tamai i‘a mo se mea‘ai.

O vete, pooiasina e feoa‘i faatasi ma faalatalata i lalo o le oneone aua le faaogaina o a latou ‘ava ile sueina o mea‘ai i le oneone. O le malie ua malolo lelei lava i totonu o se ana ina ua uma saga aiga tele o le afiafi i se ula lapoa.



### **Na mea ko‘akā Pakipika: nā mea ‘au‘au**

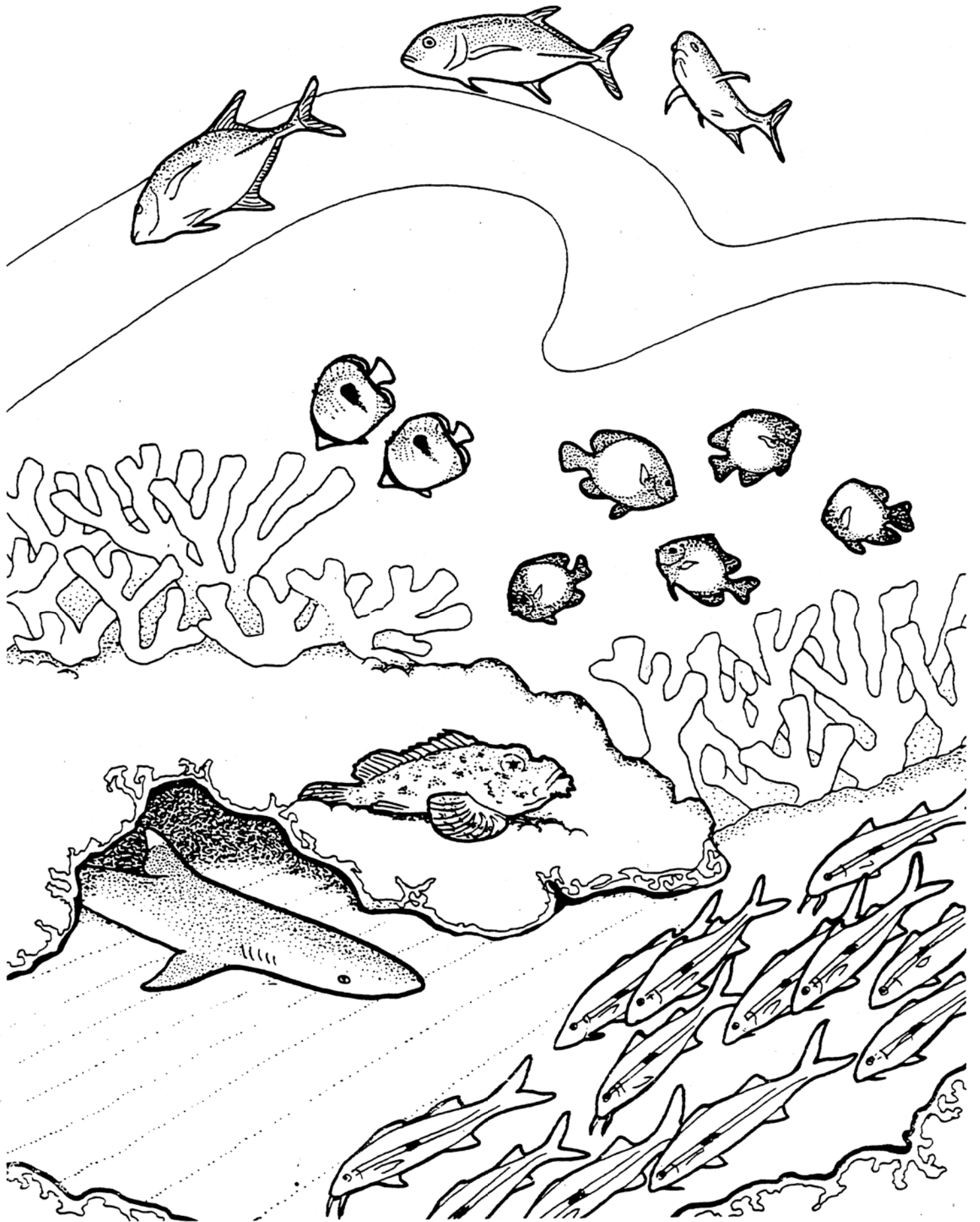
Ua like‘ole nā i‘a ko‘akā me nā kinona, waiho‘olu‘u, a me ko lākou mau ‘ano.

Ho‘omāka‘ika‘i mamao kekahi, a noho kokoke kekahi.

Ua ‘ikaika loa ka ‘ulua. ‘A‘ole lakau noho ma ke ko‘akā, akā ho‘okipa paha e hāhai i ka mea‘ai. Noho wale kekahi lauhau ma ho‘okahi ‘apana ko‘a.

‘Au‘au kekahi i‘a ku ma luna o ke ko‘a, e ‘ai nei i ka limu, me ka noho waie‘ana o kekahi nohu ma ka pōhaku, me nā helehelena like. He kohu pohaku ko ka nohu.

‘Au‘au ka weke kokoke i ka papaku, a laila hiki ke ho‘opā i ka mea‘ai me nā ‘umi‘umi. ‘Ike lākou i kekahi manē lālākea e ho‘omaha nei ma hope o kana ‘ai ‘ana i kekahi ula.





### The reef during the day

Two butterfly fish feed on a rock covered with limu (seaweed). Nearby, a moray eel pauses as a cleaner wrasse nibbles at the small parasites living among the teeth of the eel. The eel does not eat or chase the cleaner wrasse away.

Instead, the eel encourages the wrasse to keep removing pests by keeping its mouth open and remaining very still. In this way, both fish benefit: the eel gets rid of parasites, and the wrasse gets a meal. This is called commensalism. Many creatures that live among the reef have developed different types of close relationships. In order to survive, one species must depend on the other.

The parrotfish makes scraping sounds as it bites chunks of dead coral, which are covered with a green film of organisms called algae. The parrotfish digests algae and passes out coral skeleton as sand. It swims on as a school of milletseet butterflyfish glides past. Some butterflyfish also feed on algae. Their grazing helps keep the fast-growing algae from covering the reef.

### O le a'au ilea ao

O tifitifi e lua o luu 'aai i limu o pipii i luga ose maa. E latalata ane i ai se pusi o loo faamamaina ona tainifo e le sugale faamama. Ua fiafia le pusi i le galuega lenei a le sugale o fai, ona e ave'esea mai ai manu iti faasoosa i lona olaga. E lē aia foi e le pusi pe tulia ese lenei sugale, e nao le ola fealofani i laua. O le aveesea o manu iti mai le tino o le pusi e maua ai mea'ai a le sugale ae māmā ai le tino ole pusi. O le tasi lea o mafutaga mafana i le va o le tele o meaola o le sami, e tatau lava ona lagolago le isi meaola i le isi pea fai e olaola umi ma lelei pea.

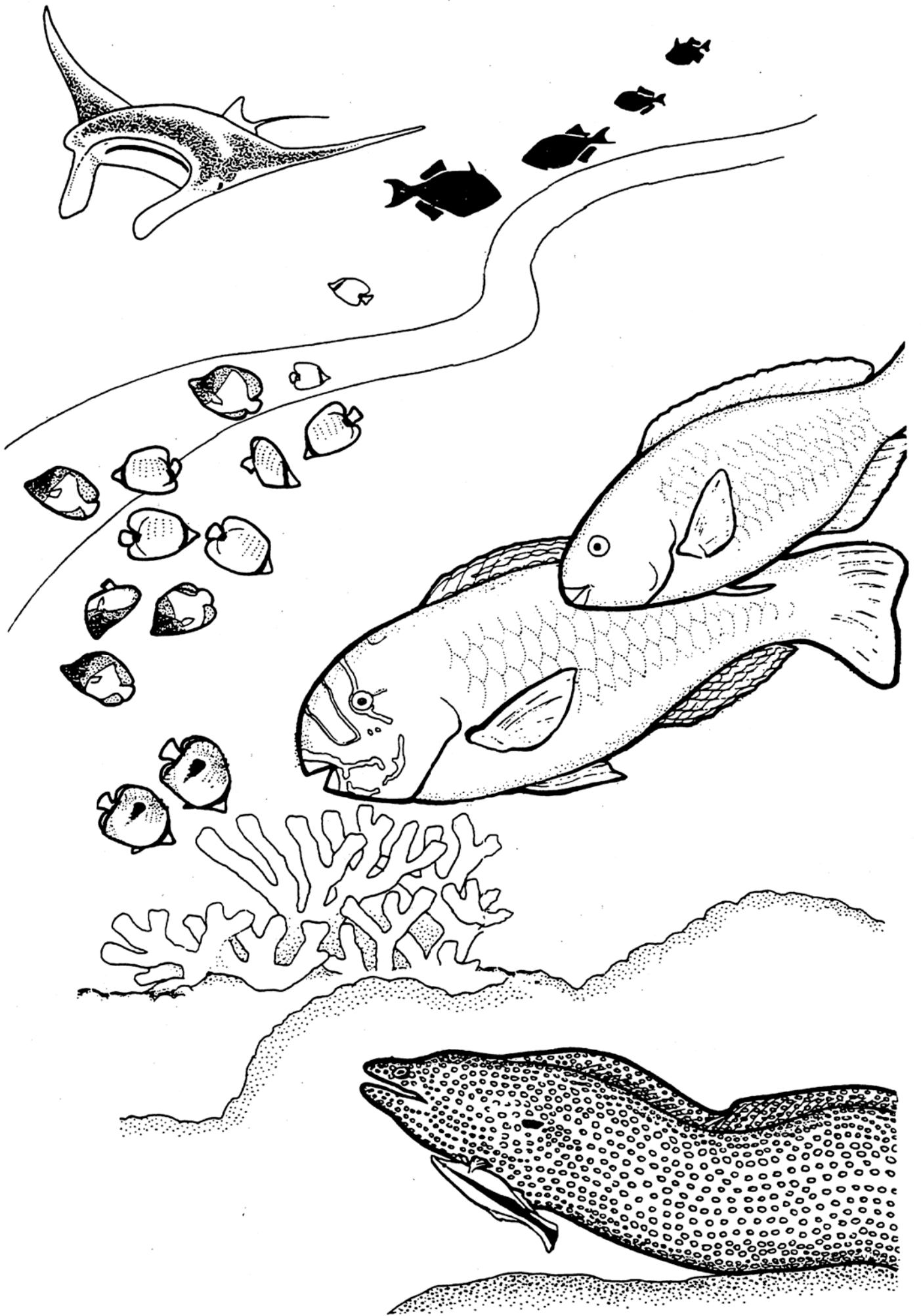
O fuga latou te galia pito o 'amu ae 'ai limu o pipii ai. E faaaogaina limu ao 'amu e faasau i fafo ua manaia le papae ma avea ma oneone. O isi ituaiga tifitifi o lo'o pasi ifo, e fiafia foi i latou ia e 'aai i limu o lo'o ola faasolo atoa i luga o le a'au.



### Ma ka la

'Ai 'elua lauhau i ka limu ma kekahi pōhaku. Kokoke, kū kekahi puhi i kona 'ike'ana i kekahi *wrasse* e 'ai nei i ka mea'ai ma kona mau niho, me ka hāhai'ole. Paepae ka puhi i ka *wrasse* e ho'omau i kāna hana. 'O kēia ke alulike. No ka ho'omau'ana i ke ola, pono nā mea kai e alulike.

Ho'o kani ka 'uhu i kona 'ai'ana i nā 'apana ko'a hala ho'opo'i 'ia me ka limu. 'Ike 'o ia i kekahi lauwiwili, 'ai no ho'i ka lauwiwili i ka limu. A ua maika'i kā lākou 'ai ana no ka ho'oma'ema'e'ana i ke ko'okā.



## The reef at night

When night falls, the reef takes on a different appearance. Some of the corals now look soft and fuzzy as the many polyps spread their tentacles to catch food. Uncurling its slender arms, a brittle starfish emerges from its hiding place inside a rock crevice. Spiny lobsters and octopi leave their resting places to hunt for snails, worms and small crabs.

Fish that have been sleeping during the day come out to feed at night. Small red cardinal fish wake to eat plankton. Other fish sleep at night, some wedge themselves into small cracks so that the current will not sweep them away while they sleep. The parrotfish blows itself a cocoon of mucus to sleep in; the cocoon helps hide the parrotfish from predators.

## O le a'au i le po

A malu ae loa le afiafi ma oo i le po, ona sui foi lea o le vaaiga ile a'au. O meaola sa lalafi ile ao ua taufai o mai i fafo e saili mea'ai. O le tele o 'amu ua vaaia le lamolemole ma le falala mai i fafo ave felefele o polipo i le tau pueina o ana mea'ai. O le tasi foi o aveau lena ua oso mai i fafo mai lona faamoega. E oo foi i ula ma fe'e ua tuua o latou nofoaga ae saili i anufe, sisi poo tamai pa'a foi aua latou meaai.

O i'a na momoe pe lalafi i pu o 'amu i le ao e o mai i fafo i le a'au i le sueina o mea'ai. O isi i'a na feoi i le ao ua momoe i le po e i ai le fuga. O le fuga e saunia lava e ia lona falemoe e lafi ai ma moe filemu mai ona fili.



## Ma ka pō

I ka nāpo'o'ana o ka lā, lilo ke kohu o kekahi mau ko'a. I kēia manawa, ua palupalu kekahi, a ho'opuka kekahi. Ha'alele kekahi ula a me ka he'e e hāhai i ka mea'ai liki'ole.

Ho'opuka kekahi i'a hiamoe lā e 'ai i ka pō. 'Ai ka 'aweoweo i ka limu. A hiamoe ika kekahi i'a'e a'e i ka pō ma kekahi lua pale. Puhi ka 'uhu i kona hale moe pale.



## The coral reef is a living system

Our visit to the coral reef has taught us many things: every plant and animal on the reef has a special role to play. Some animals are active by day, while others are active by night. Each has its own living space. Each has certain kinds of food, and in turn may also be a source of food for others. Some animals create homes for others to live in. Many have close relationships, each providing something the other needs.

The coral reef is a balanced system where all things have their special place and function. In a system, all things are related. All the plants and animals of the reef depend on each other.

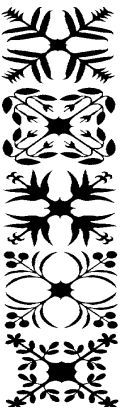
Our whole earth is a system, too. Does this mean coral reefs are important to us, even if we don't live near one?

## O le a'au ole nofoaga ola faatasi

I le tatou maimoaga i le a'au, e tele mea aogā ua mafai ona tatou maua: e tofu lava le meaola poo laau foi o le a'au mo lona aogā poo lona tulaga. E i ai meaola e feoa'i i le ao, e feoa'i isi ile po. E tofu lava le meaola ma lona nofoaga i le a'au. E isi meaola e faia mea e nofo ai isi meaola. E tofu lava le ituaiga meaola ma ana mea'ai pe 'ai foi e le isi meaola le isi. Ao le tele o meaola o le a'au e nofo fesoasoani le isi i le isi.

O le tulaga o faiga mea i le a'au e paleni lelei. E tofu lava le meaola ma lona aoga ma lona nofoaga foi ina ia mafia ona lelei le faasologa o mea uma. O le a'au foi e faalagolago tele le isi meaola ma laau foi i le isi, o le mea foi lea e tatau lava ona i ai uma meaola ma laau o le sami e ola faatasi.

A ave'esea se fasipito poo le meaola foi o lenei tu'ufaatasiga e mafai ona talepeina ma faaleagaina le a'au atoa.



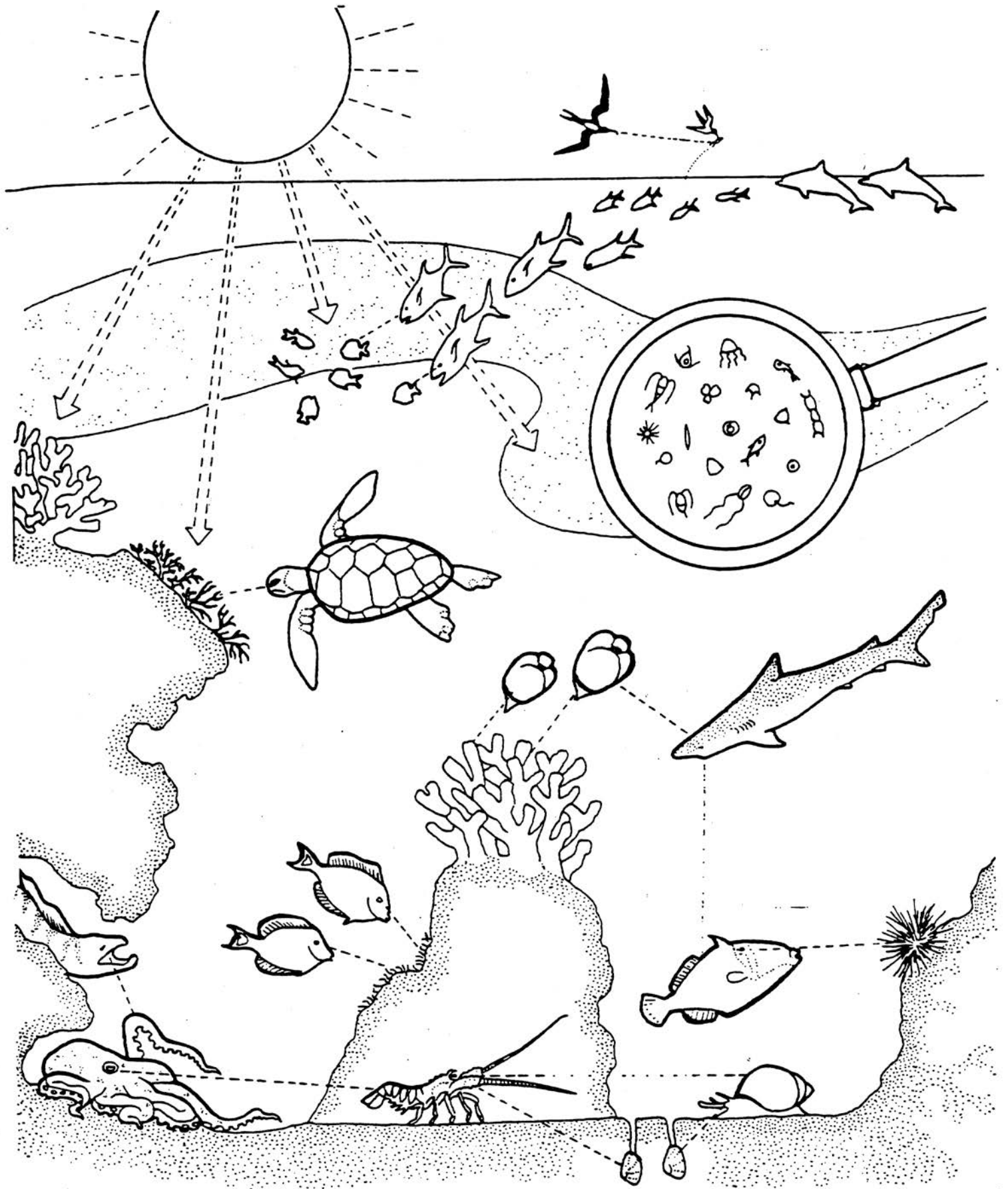
## He hui ola ke ko'akā

Ua a'o mai kākou i na mea nui: he lawelawe hana kā na mea pākahi. Maka'ala kekahi ma ka lā, a kekahi ma ka pō. He mau hale pōno'ī ko na mea a pau. Loa'a i na mea pākahi ka mea'ai pōno'ī, a he kumu'ai kekahi no kekahi. Ho'okūkulu kekahi i nā hale. A alulike lākou i kekahi i kekahi.

He wahi pono ke ko'akā.

He wahi pono ka honua no ha'ii. No ke aha he mea nui nā ko'akā no kākou a pau?





### Why are coral reefs important?

Many of the fish we eat rely on the coral reef in some way: for food, shelter, a breeding ground, or a nursery for their babies. Parrotfish, octopus and lobsters are just three of the many important animals that depend on the reef to survive.

Coral reefs act as barriers that protect our beaches. Strong ocean waves break on the reefs before they reach shore. This helps keep our shoreline from being washed away and creates safe anchorage for our boats.

Coral reefs are an important source of sand for our beaches.

The reefs may one day be a source of medicines. Researchers have found that some corals provide important pharmaceutical drugs.

Visitors come from around the world to see Pacific reefs. This creates jobs and other employment opportunities for the people of the Pacific.

Coral reefs are places of beauty and wonder. That alone makes them important!

### Aisea e taua ai a'au?

O i'a ma figota a loo fiafia tatou e 'ai e lagolago tua tele latou i le a'au: mo mea'ai, lafitaga, mo feusuaiga atoa foi ma nofoaga e faafailele ai a latou fanau. O le fuga, ulua ma le ula o ni meaola taua nei e manaomia tele le a'au.

O a'au e puipuia o tatou matafaga matagofie ae maise foi tatou le tagata. A fati mai galu tetele, e muamua lava ona taofia le malosi o nei galu e le a'au ae lei oo mai i uta i matafaga. O le fesoasoani lenei a a'au 'amu e le mafai ai ona tafia ese o tatou matafaga. O le mea foi lea e le tatau ai ona tatou laua le oneone poo le iliili lea ei luga o tatou matafaga.

O a'au 'amu foi e maua mai ai le oneone paepae manaia lea e vaaia i luga o tatou matafaga.

Atonu e iai ni aso o i luma e mafai ona maua mai ai ni vailaau mai o tatou a'au. O tagata sutesue ua mauaina e i ai ituaiga 'amu lea e aoga i le faiga o vai.

O le matagofie o a'au o le Pasifika ua ala ona o'o mamao mai ai tagata asiasi i lenei itu o le lalolagi. Ua mafai ona fesoasoani lea i tagata o le Pasifika i galuega ma isi tulaga o le soifuaga alu i luma.

O a'au o nofoaga ofoofogia ma maoa'e lona manaia. E le lava ea lena mafua'aga e tatau ai ona taua puipuia a'au!



### Nā mea nui?

Kāko'o ke ko'akā i nā i'a a kā kākou 'ai'ana. 'O 'ekolu o nā mea i kauka'i i ke ko'akā, 'o ia nō: ka 'ulua, ka 'uhu, a me ka ula.

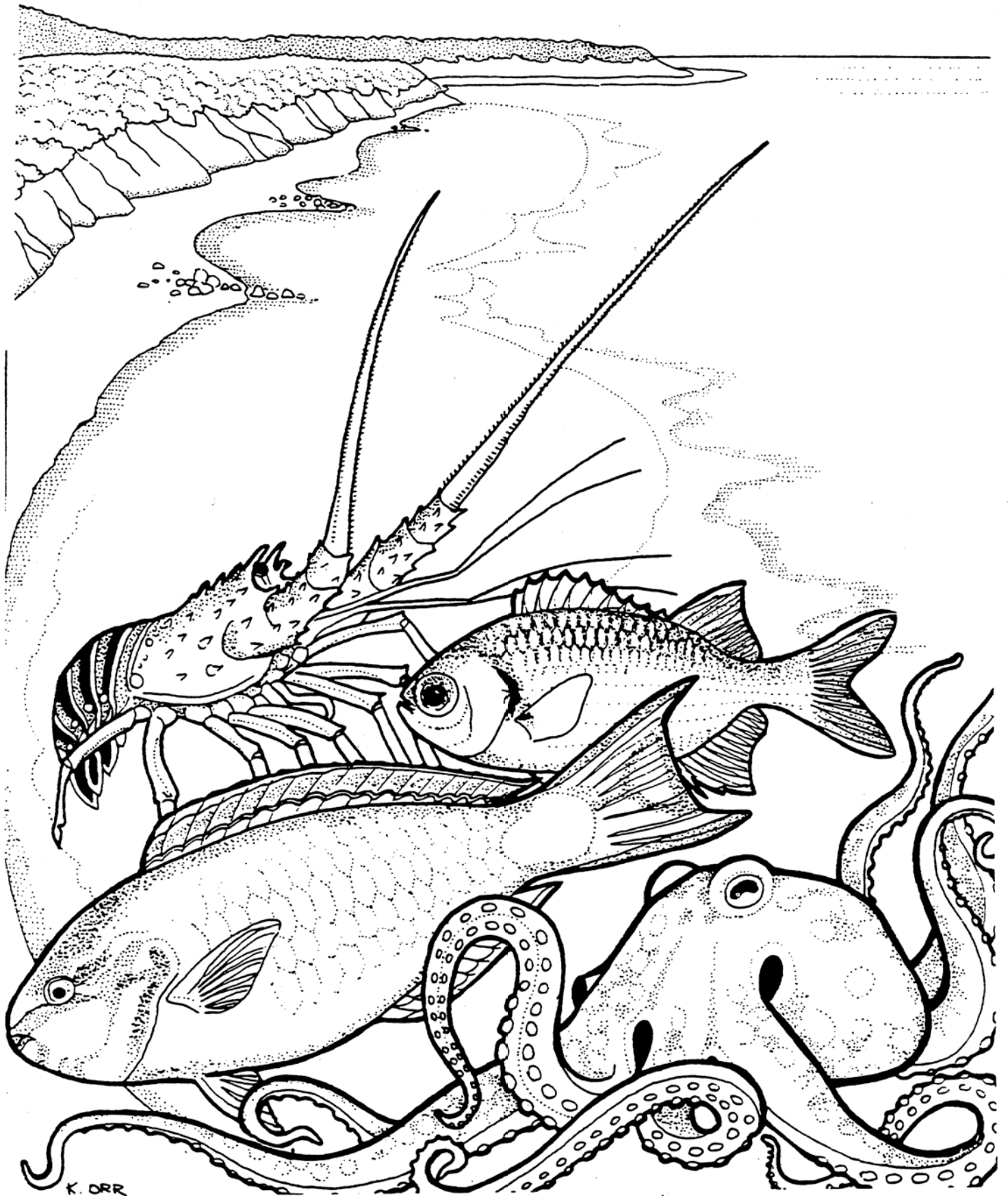
Ho'opale ke ko'akā i ke kahakai i nā nalu nui. Kōkua kēia i ka lihikai. He kumuone nā ko'akā no nā kahakai.

He kumu lā'aulapa'au kekahi.

Hele mai nā malihini mai na wahi a pua i ka honua e 'ike i nā ko'akā Pakipika. He wahi hana no kekahi po'e kekahi.

He mau wahi kamaha'o a nani nā ko'akā. No keia kumu wahi, he mea nui ke ko'ake.





### **Reefs depend on their surroundings**

Coral reef systems cannot exist by themselves. They depend upon warmth and light from the sun. The surrounding ocean must supply fresh, clear seawater. Some reefs need the help of nearby estuaries. Estuaries are areas where fresh and salt water comes together to form a marsh. Places such as Hanalei (Kaua‘i), Kane‘ohe Bay (O‘ahu), Kealia Fishpond (Maui), Waipi‘o Valley (Hawai‘i), and Leone and Nu‘uuli Pala (Samoa) are just a few examples. Estuaries keep seawater clean by trapping the soil from the land that washes down in a heavy rainstorm. Many reef animals need the estuary to feed and shelter their young.

Because the coral reef depends on its surroundings, changes in the nearby environment will also affect the reef. Like the rainforests, the reef is a living system: damage to one part will hurt the rest. This means coral reefs can be damaged easily. And since corals grow so slowly, the damage is not easily repaired.

### **E faalagolago a‘au i le siosiomaga**

O a‘au e faalagolago tele i le mafanafana ma le susulu o le la. E le mafai ona olaola lelei le a‘au pea palapalā ma i ai faafitauli isi vaega o le sami. E tatau lava ona māmā ma manino le sami. O isi a‘au e manaomia le fasoasoani a nofoaga e iai taufusi ma pala pei o Pala i Leone ma Nu‘uuli. O taufusi o nofoaga ia e fetau ai le sami ma le vai. E aogā tele taufusi poo pala e faamāmā ai le vai lea e tafe mai i le laueleele agai atu i le sami ae maise lava taimi o timuga. O le tele foi o meaola ma i‘a o le sami e faaaogaina nei nofoaga e faafailele ai, fafaga ai ma tausi ai a latou fanau.

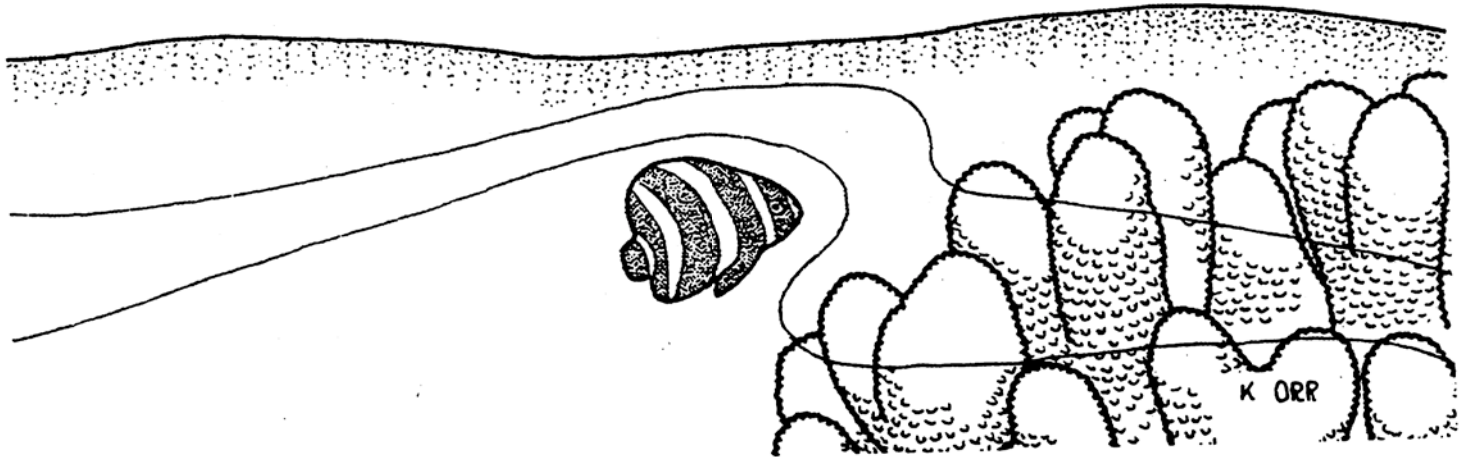
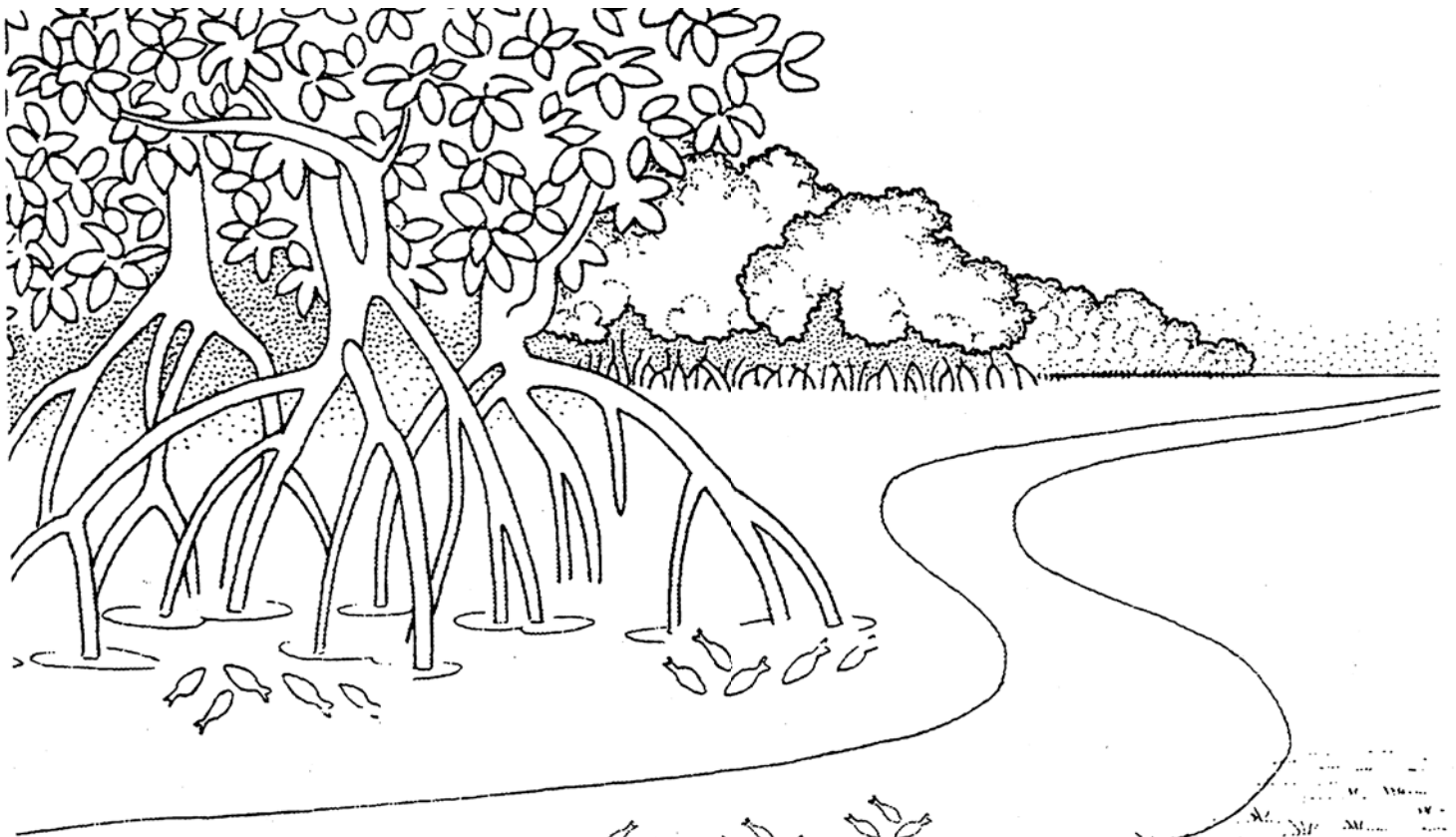
E mafai ona afaina le a‘au i soo se suiga lava e tupu i lona siosiomaga. O le a‘au e faapei o le vaomatua, ona o se nofoaga e ola faatasi uma ai meaola poo laau o maua ai, a tupu se faafitauli i se tasi vaega, o le a afaina ae le nofoaga atoa.



### **Kāko‘o ke na mea e ho‘opuni ana i ke ko‘akā**

Pono nā ko‘akā i na mea e ho‘opuni ana; ka ho‘omehana o ka lā, ke kai, a me ke kōkua o kekahi muliu. E like me Hanalei (ma Kaua‘i), Kane‘ohe (ma O‘ahu), Kealia (ma Maui), Waipi‘o (ma Hawai‘i), a me Nu‘uuli Pala (ma Samoa). He mea pono no kekahi muhiwai e hānai‘ai a ho‘opale i kā lākou mau keiki.

Ho‘ololi na mea ho‘opuni ana i ke ko‘akā. ‘O ka hana‘ino o kekahi ‘apana, he mea ‘ino no nā mea holo‘oko‘a.



### **How are coral reefs damaged?**

Heavy storms smash and overturn corals.

People use explosives to blast channels and catch fish.

People collect chunks of coral to sell.

People touch or stand on coral and kill the soft polyps.

Catching too many fish unbalances the coral reef ecosystem.

In some areas of the world, divers use bleach to catch lobsters and fish. Bleach kills corals and other reef animals.

Coral reefs have been killed by shoreline development. Land clearing, building construction, and harbor dredging all put silt into the water. Silt smothers and kills corals.

Pollution from sewage, chemicals, and oil kills reefs.

Damage from storm cannot be helped, but damage by people can usually be avoided.

### **Pe faapefea ona faaleagaina a'au**

O matagi malolosi e mafai one nuti ai 'amu ma faaleagaina ai.

O le faaaogaina o fanai'a e fagogota ma faapā ai papa.

O le aoina ma le faatauina atu i tagata turisi o 'amu.

O le soli i vae ma le tago i 'amu e pēpē ai.

O le soona fagota ma le faapalepale ua le mafai ai ona tutusa tulaga o le a'au.

O le faaogaina o vailaau e pu'e ai ula ma 'ia, e tele ona mamate ai i'a laiti, 'amu ma isi meaola.

O galuega e iai le suaina o mea e fai ai uafu i taulaga, suaina o fanua mo faiga o fale ma isi lava fuafuaga o le eli'ina o fanua e mafai ona tele ai le palapala e o'o atu i le sami. O nei palapala pēpē ai 'amu ona ua le mafai ona maua se 'ea mai le sami māmā ma le manimo.

O figota, i'a ae maise 'amu o le a'au e tele ona pēpē i suauu ma kemirale faapea faletaele ua faaalu agai i le sami. O le faatama'ia o a'au e tagata e mafai ona fai i ai a tatou fuafuaga ma taumafai e taofi ia faiga leaga, ao matagi malolosi e iai afā ma isi faalavelave faanatura e faigata ona fai iai se fuafuaga a le tagata soifua.



### **Nā mea 'ino no nā ko'akā?**

Nā mea pahu.

Ka 'ohi'ana o nā po'e e kū'ai aku.

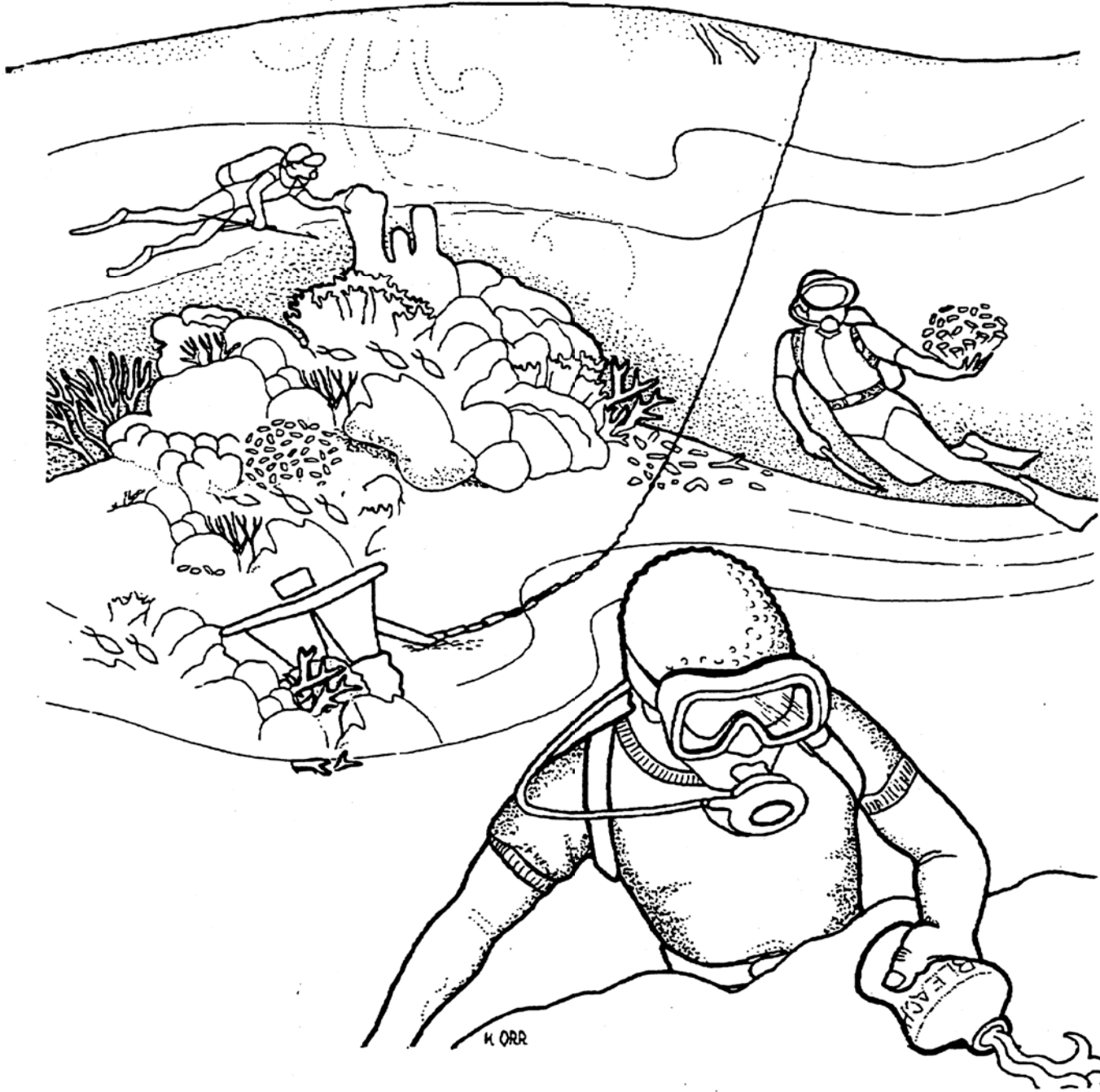
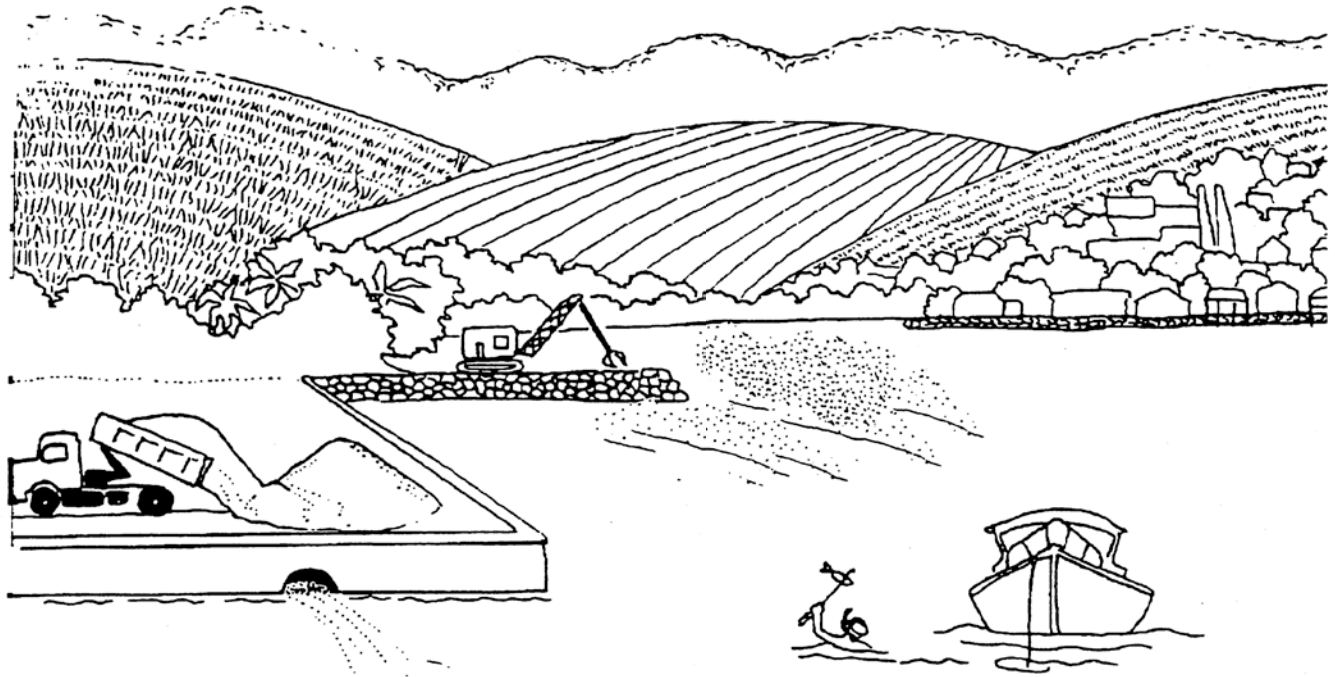
Ka ho'ohala'ana i nā 'uku ko'ako'a me nā ho'opā'ana.

Nā po'e lawai'a pono'ole.

Ke kūkulu'ana o nā hale i ka lihikai.

'O ka mea nui ka hana'ino o nā po'e.





M. ORR



### Can a damaged reef recover?

Certain snails, worms and fish eat coral polyps. They create small dead spots on the living coral surface. In a healthy reef, this is not a problem. The surrounding polyps can spread over these small spots and repair the damage. But large spots of dead coral cannot be repaired because the polyps grow more slowly than other creatures.

Algae and sponges settle on bare, hard surfaces and grow rapidly. They quickly cover the area and prevent new polyps from settling there. Many boring sponges, clams, sea urchins, snails and worms scrape holes for their homes in the coral rock. The animals weaken the coral. Eventually the coral will crumble.

A damaged reef may take twenty to fifty years to recover. Those seriously harmed by silt or pollution may never recover.

### E mafai ona toe faaleleia se a'au ua faaleagaina?

E i ai meaola o le a'au e iai tamai sisi, anufe sami ma i'a ae maise le alamea e fiafia e 'aai i polipo o 'amu. Afai e laititi se nofoaga a'ia ma afaina e nei meaola, e faigofie lava ona toe ola mai 'amu i le fesoasoani a isi meaola o le a'au. Ae peitai, a tēlē se pito o le 'amu ua a'ia ma afaina, e faafaigata ona toe foi le 'amu i lona tulaga lelei ona e tuai le tupu a le 'amu.

O limu e vave tele ona sosolo ma ola i luga o nofoaga e le'o ola ai nisi mea. O le pogai foi lea e faigata ai i polipo fou ona maua ni latou nofoaga e mau ma ola lelei ai. O le tele o meaola ole sami e faamomoe lava i 'amu mo a latou meaa, lafitaga ae maise foi se nofoaga e faamautu ai.

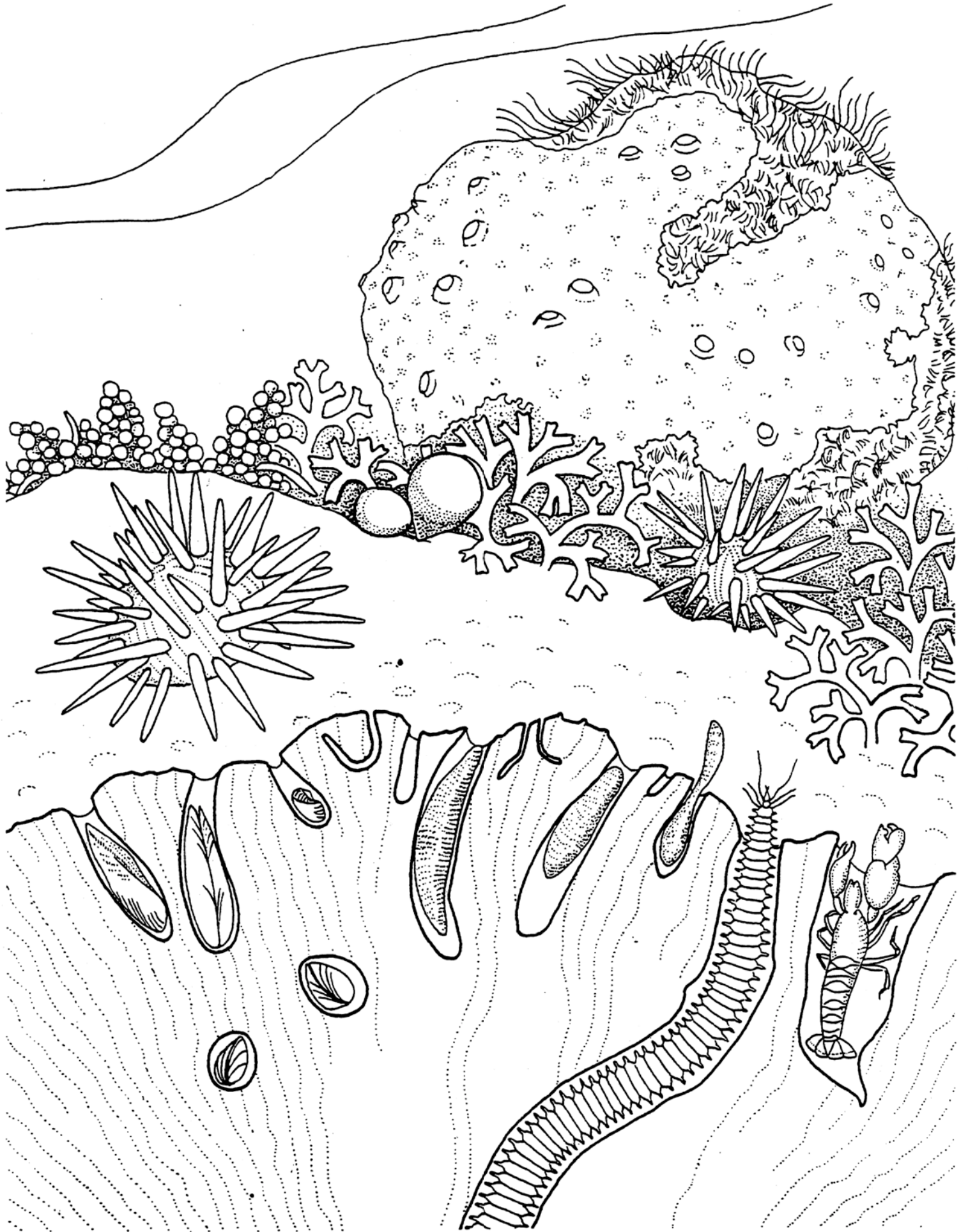
O se a'au ua faaleagaina, e tusa ole 20 e o'o i le 50 tausaga ona toe vaaia lea ua toe mataola mai. O a'au ua matua faaleagaina lava pei o le ufitia i palapala ma otaota e le toe mafai ona toe olaola lelei.



### Hiki i kekahi ko'akā pō'ino 'ia ke hō'ola hou 'ia?

'Ai kekahi mau kamaloli, nā ko'e a me nā i'a i nā uku ko'ako'a. Hana lākou i kekahi mau wahi 'āpana make ma ka 'ili o ke ko'akā ola. 'A'ohē pilikia ma kekahi ko'akā maika'i. Hiki i nā uku ko'ako'a ke pālaha ma luna o kēia mau wahi 'āpana no ka hō'ola 'ana i ka pō'ino. Akā no na'e, 'a'ole hiki i nā 'āpana nui o ke ko'akā make ke hō'ola 'ia no ka me 'oi aku ka lohi o kēia ulu 'ana ma mua o nā mea ola 'ē a'e.

Noho nā limu a me nā 'ūpī ma luna o nā papa pa'a kohana a ulu koke lākou. Uhi koke lākou i kēia ma papa pa'a a 'a'ole hiki i nā uku ko'akā ke noho iho. 'Eli nā 'ūpī ho'owili, nā 'olepe, nā wana, nā kamaloli a me nā ko'e i nā poho i loko o nā ko'akā; 'o ko lākou mau home kēia. Ho'onāwaliwali kēia mau mea kai i nā ko'akā. Ho'opau koke 'ia nā ko'akā. Hō'ola hou kekahi ko'akā i nā makahiki lō'ihi he iwakālua a he kanalima paha. 'A 'ole hō'ola hou kēlā mau ko'akā i pō'ino nui 'ia e ka lepo a i'ole nā mea ho'ohaumia.



### The future of our reefs

People are learning how easily coral reefs can be damaged, and how difficult it is for damaged reefs to recover. We recognize the importance of our coral reefs and are learning how to protect them. Many countries have established marine sanctuaries and reserves to protect certain reefs and the animals that breed and live there. Visitors to these areas can enjoy the beauty of the reef. Scientists can also protect the reefs. For example, by studying the ocean currents they can predict which reefs will be harmed by shoreline development before the damage is done.

We can help protect reefs, too:

By not handling or picking up coral.

By obeying our fishery regulations.

By teaching others what we have learned about the reefs.

The coral reef is a place of wonder and importance. Let's keep our coral reef healthy—for their sake and ours.

### Lumanai o a'au

Ua toatele tagata ua malamalama lelei i le aogā o a'au faapea foi le faigata ono teo ola se a'au ua faaleagaina. Ua iloa foi e le lautele auala e mafai ona fesoasoani ai i le puipuia o a'au ae maise o tatou ogasami. E tele atunuu e matagofie tele o latou a'au amu ile maimoa a tagata. O nei atunuu ua faia ni nofoaga faapitoa ma puipuia e mafai ona ola lelei ai meaola o le sami ae maise amu. O tagata sueseua e iai saienitisi e mafai foi ona latou fesoasoani i le puipuia o a'au. O a latou suesuega e aogā tele i le fuafuaina o galuega e tatau ona fai ina ia faaitiitia ai le faaleagaina o a'au ma le sami atoa.

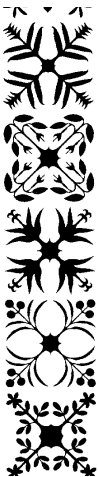
E mafai foi ona tatou fesoasoani i le puipuia o a tatou lava a'au:

Aua le 'ave'esea 'amu mai ile sami.

Usitai i tulafono tau faagotaga.

Ao'ao atu isi ina ia malamalama atili i a'au mo a tatou sami.

O a'au ose nofoaga ofo'ofogia le matagofie ma matalasi. Tatou puipuia ma faasaoina a tatou a'au mo le manuia o meola o le sami ae maise oe ma au.



### 'O ko kākou ko'akā i ka wā ma hope

E a'o mai ana nā kanaka i nā mea i ho'onāwaliwali i nā ko'akā; 'ike lākou i ka hana nui e hō'ola hou i nā kokākou pō'ino 'ia. 'Ike pono kākou i ka 'ano nui o ko kākou mau ko'akā a ko kākou mālama 'ana iā lākou.

Ka'awale kekahi mau aupuni i nā wahi ho'āno kai a me nā kai kapu no ka ho'omalū 'ana i kekahi mau ko'akā a me nā mea ola e noho a ho'olu ma laila.

Hiki i nā kākou māka'ika'i ke ho'onanea i ka nani o ke ko'akā. Hiki i nā kākou akeakamai ke ho'omalū ho'i i nā ko'akā. I ka hākilo i nā au ma ke kai, hiki iā lākou ke wānana i nā ko'akā i pō'ino 'ia ana e ke kŭlulu 'ana ma ke kahakai.

'Ike 'ia kēia mau mea ma mua o ka nāna 'ana i ka pō'ino.

Hiki iā kākou ke kōkua, ke mālama ho'i i ke ko'akā. Mai pā a limalima 'oe i ke ko'akā.

E mālama 'oi i nā kākou a me nā kapu i'a.

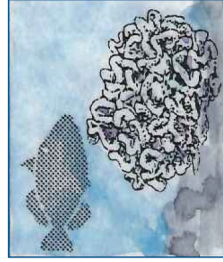
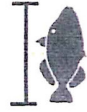






# Hawai'i Coral Card

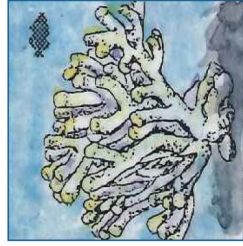
10 cm or 4 in.



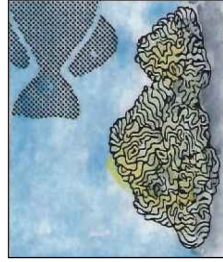
Cauliflower Coral  
Ko'a  
*Pocillopora meandrina*



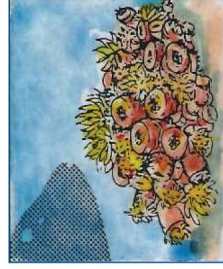
Lobe Coral  
Puna  
*Porites lobata*



Antler Coral  
Ko'a  
*Pocillopora eydouxi*



*Pavona varians*



Orange Cup Coral  
'ako'ako'a  
*Tubastraea coccinea*



Mushroom Coral  
'Ako'ako'a kohe  
*Fungia scutaria*



Crust Coral  
*Leptastrea purpurea*



Blue Rice Coral  
*Montipora flabellata*



Rice Coral  
Ko'a  
*Montipora capitata*

## CARE FOR OUR CORALS

Corals are living creatures and will easily be harmed by careless people. Please help us protect our fragile corals!



Standing or walking on reefs can break or damage corals.  
Wāwāhi paha ka hapapa ke hehi a'e.  
Auf dem Riff stehen und laufen kann die Koralle zerstören.  
Ole tu po'o le savali i luga o 'a'u e faaleagaina ai 'amu.  
Ti agtakder wenno magmagna kadagiti rabao ti sabong ti baibato ket perdien na dagitoy nga sabong ti bato ti baybay.  
岩礁の上に立ったり、上を歩いたりするとサンゴが壊れてしまいます。



Touching reefs can break or damage corals.  
Wāwāhi paha ke ko'a ke ho'opā.  
Das Riff (Koralle) anfassen kann kie Koralle brechen und zerstören.  
Ole tago i 'amu e mafai ona gau pe faaleagaina ai.  
Ti mangsagid kadagitoy nga sabong ti bato ket perdien na dagitoy nga sabong ti bato ti baybay.  
岩礁にさわると、サンゴが壊れたり傷ついたりします。



Kicking up sand smothers and kills corals.  
Po'ipo i a make ke ko'a i ka pekupeku o ke one.  
Sand aufwirbeln kann die Koralle ersticken.  
Ole kikiina o oneone i luga o 'amu e pepe ai.  
Ti mangkogtar kadagitoy nga dardarat ket mermeran na ket matay dagitoy nga sabong ti bato ti baybay.  
砂をけり上げると、サンゴを窒息させたり、死なせてしまうことになります。

**TAKING OF LIVE CORALS IS PROHIBITED BY LAW:** Hawai'i state law prohibits the taking of any stony corals from the waters of Hawai'i, including any reef or mushroom coral. Violators may be subject to a fine of up to \$500 and/or 30 days in jail.

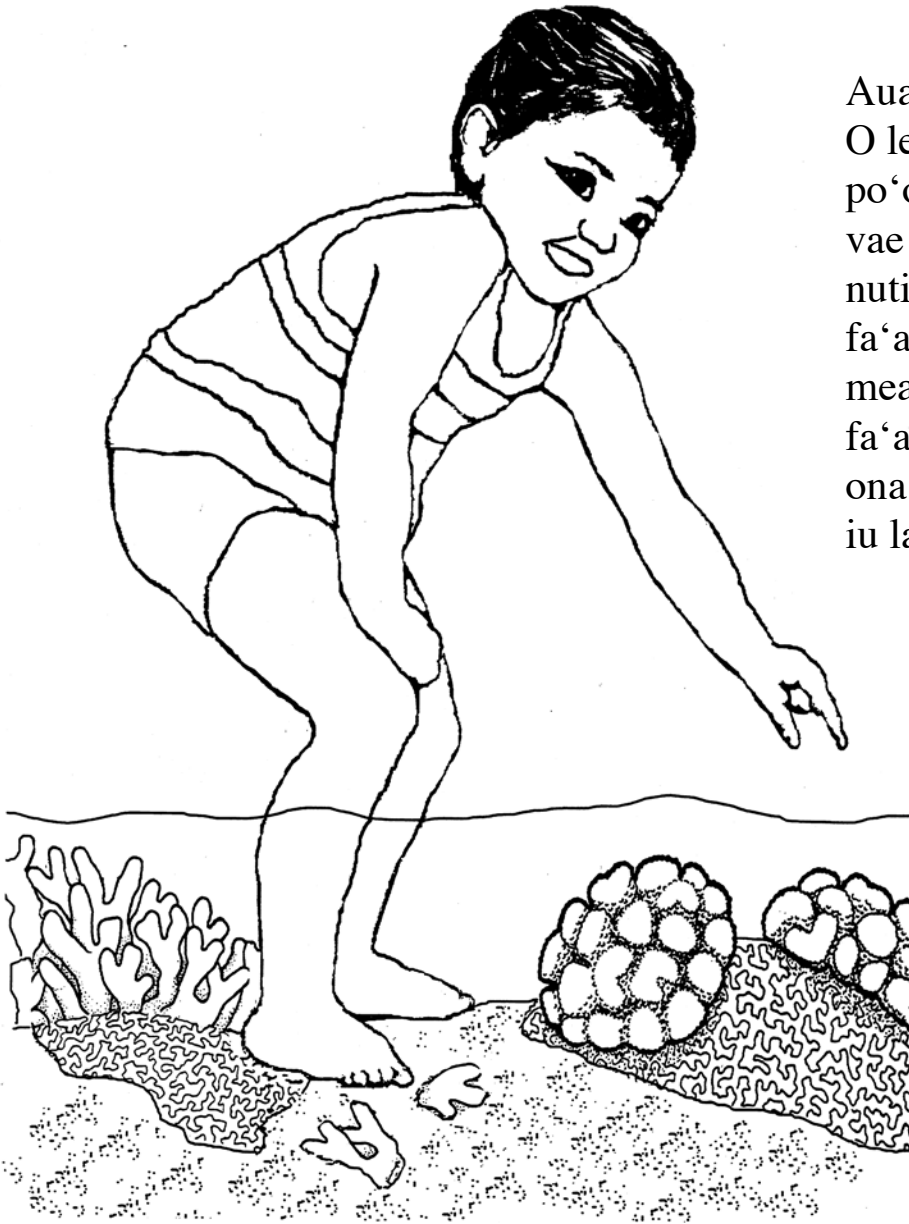


Revised 2015  
Office of National Marine Sanctuaries Pacific Islands Region  
Illustrated by Dave Raney

Created by the Hawaiian Islands Humpback Whale National Marine Sanctuary and the Sierra Club, Hawai'i Chapter  
Watercolorist Joan Terhorst. ©1996



Don't touch live coral!! Stepping on coral can break fragile pieces. Footsteps and handprints can damage the living coral. Damaged coral tissues can become diseased and die.



Aua le tago i 'amu!!  
O le tago o ou lima  
po'o le tu foi o ou  
vae i luga o amu e  
nuti ai ma o'o ina  
fa'aletonu nei  
meaola. O 'amu ua  
fa'aleagaina e mafai  
ona maua i ma'i ma  
iu lava ina pepe ai.



Mai pā 'oe i ke ko'akā ola!! Inā hehi 'oe i ke ko'akā,  
hiki iā 'oe ke haki i ko lākou mau lālā palupalu. Hiki i  
ka hehi 'ana a me ka pā 'ana ke hō'ina i nā ko'akā ola.  
Lilo ke ko'akā pō'ino 'ia i ko'akā mai a make.

## State laws protect the coral reefs of Hawai'i and American Samoa

### American Samoa

It is against the law to take live coral above 60 feet.

### Hawai'i:

#### **Taking or damaging coral, live rock and coral rubble** HAR 13-95

State law prohibits the intentional take, break or damage, of any stony coral, including any reef or mushroom coral.

It is unlawful to damage any stony coral or live rock by any intentional or negligent activity causing the introduction of sediment, biological contaminants, or pollution into state waters.

It is unlawful to intentionally take, break or damage, with any implement, any rock or coral to which marine life of any type is visibly attached or affixed.

The taking of sand, coral rubble, or other marine deposits is permitted in certain circumstances. The material may not exceed one gallon per person per day, and may be taken only for personal, noncommercial purposes.

#### **Sale of corals**

The sale of the following eight species of stony corals is prohibited in Hawai'i:

1. Rose coral or cauliflower coral, *Pocillopora meandrina*
2. Lace coral, *Pocillopora damicornis*
3. Giant finger or antler coral, *Pocillopora eydouxi*
4. Yellow-lobed coral, *Porites lobata*
5. Finger coral, *Porites compressa*
6. Mushroom coral or razor coral, *Fungia scutaria*
7. Orange coral or cup coral, *Tubastraea coccinea*
8. Rice coral, *Montipora capitata*

#### **Penalties**

Most violations are subject to a fine up to \$500 and/or thirty days in jail, plus up to \$100 per specimen taken illegally (first conviction).



## National Marine Sanctuaries

The United States Congress created NOAA's National Marine Sanctuaries Program as a result of the 1972 Marine Protection, Research and Sanctuaries Act. This act authorized the Secretary of Commerce to designate discrete areas as national marine sanctuaries to promote comprehensive management of their special conservation, recreation, ecological, historical, scientific, educational, cultural or aesthetic resources. The Office of National Marine Sanctuaries System's mission is to serve as the trustee for the nation's system of marine protected areas to conserve, protect, and enhance their biodiversity, ecological integrity and cultural legacy.

**To find out more about your National Marine Sanctuary System,  
visit our website [www.sanctuaries.noaa.gov](http://www.sanctuaries.noaa.gov)**

The Office of National Marine Sanctuaries Pacific Islands Region oversees the three sites in the Pacific Islands: the National Marine Sanctuary of American Samoa, the Hawaiian Islands Humpback Whale National Marine Sanctuary, and Papahānaumokuākea Marine National Monument.

**Visit our website at [www.http://sanctuaries.noaa.gov/about/pacific.html](http://www.sanctuaries.noaa.gov/about/pacific.html)**

**The National Marine Sanctuary of American Samoa** was designated in 1986 (as Fagatele Bay National Marine Sanctuary) in response to a proposal from the American Samoa Government. Originally only comprising the fringing reef ecosystem in Fagatele Bay, in 2012, it was re-designated as the National Marine Sanctuary of American Samoa and includes seven units across the archipelago. The most remote of all the sites in the sanctuary system, the sanctuary protects the only true tropical coral reef in the US.

**Visit our website at [www.americansamoa.noaa.gov](http://www.americansamoa.noaa.gov)**

**Hawaiian Islands Humpback Whale National Marine Sanctuary** was designated by Congress in 1972 and approved by Hawai'i's governor in 1997, with a goal of protecting humpback whales and their habitat within Hawaiian waters. About half of the North Pacific humpback whale population of this endangered species migrate every winter to the warm, shallow waters surrounding Hawaiian islands. The sanctuary's mission is to ensure a healthy habitat for the humpback whale by providing innovative management through protection, conservation, community participation, research, education, compatible uses and cultural awareness.

**Visit our website at [www.hawaiihumpbackwhale@noaa.gov](http://www.hawaiihumpbackwhale@noaa.gov)**

**Papahānaumokuākea Marine National Monument** was established in 1996 and protects coral reefs and other habitats around the Northwestern Hawaiian Islands which stretch from Kaua'i to Kure Atoll, over 2,000 miles away. In 2010, it became a World Heritage Site for its outstanding natural and cultural resources.

**Visit our website at <http://www.papahanaumokuakea.gov>**



*“A‘o au i ka‘u mau haumāna ‘o ke kai kekahi mala, a e like me ka mālama‘ana o kēlā mālama‘ana o ka moana. Ma mua o ka ‘ako‘ana i kekahi mea, he mea pono e pule ma mua, i ka ‘ako‘ana e mahalo aku, a ma hope, e ho‘i i ka lepo, ho‘okanu i kekahi mea ‘e a‘e, a laila, e pule hou. Nā ke akua e mālama pono ana i ka honua a pau loa.”*

“I teach my students that the ocean is like a garden and should be tended as so. Ask permission for taking, take only what you need while offering thanks, return the surroundings how they were found, give something in return, and then pray again for the continued growth. The akua is the one who ultimately provides the perfect balance for all of nature.”

Kanela MacGregor, Hawaiian Language Teacher



*Ua faō figota ae sa‘asa‘a ‘amu o le a‘au i le ta‘alili mai o auma ma le aupeau.*

The sea creatures bowed while the corals danced to the thunderous roar of the waves of the sea. (Refers to the cooperation of the sea and all the living creatures. They live in harmony with, and respect for, their environment. Likewise, we should respect and live in harmony with ours.)

Samoa proverb provided by High Talking Chief Magele Aitaoto Seiuli

This 2015 edition was produced by the Office of National Marine Sanctuaries Pacific Islands Region (PIR). We wish to thank everyone who made this book possible.

A special fa‘afetai and mahalo to Ms. Katherine Orr, whose books, *The Hawaiian Coral Reef Coloring Book* and *The Coral Reef Coloring Book* provided most of the illustrations and much of the original text. Additional illustrations were provided by Nancy Daschbach and she and Allen Tom, both of the PIR, provided some text. Punipua Lagai-Nagalapadi translated the text into Samoan. Kanela MacGregor and Carol Silva translated the text into Hawaiian. Translations are not always verbatim, but are designed to compliment the original English text.







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Scale varies in this perspective. Adapted from National Geographic Maps.

# AMERICA'S UNDERWATER TREASURES