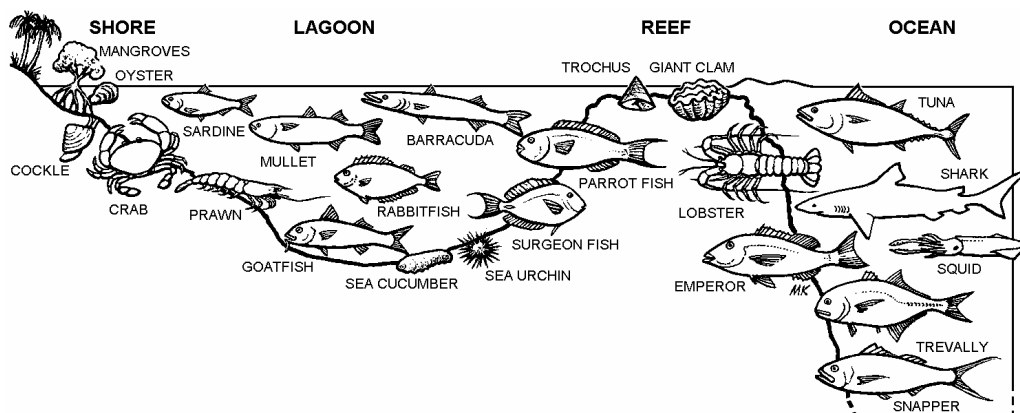


Marine Resources I

Similar to other Pacific Island countries, the coastal marine resources in Samoa have always been a major source of food for our people. The majority of rural communities in Samoa depend on these resources for protein. These resources have also become a major source of income. The export of tuna from the offshore marine resources has become a major foreign exchange earner for the country. Thus the marine resources play a vital role in the supply of protein and income in rural communities as well as for export for the country.

A survey in 2000 estimated the total annual seafood consumption for Samoa for that year to be 9,971 tons, valued at over ST62 million. Of this total, 7,169 tons or 72 % was caught in the subsistence fishery. Average consumption of seafood per capita was estimated to be 57 kg per annum, made up of 44 kg of fish, and 13 kg of invertebrates and seaweed. Consumption per capita for canned fish, canned meat, fresh and frozen meat were 14, 5.7 and 92 kg per annum, respectively. Thus local seafood makes up about 34 % of the total meat consumption in Samoa in terms of weight. However, this figure is believed to be much higher in specific communities that rely more on seafood as its source of protein. Together with fishery exports, the gross value of Samoa's marine resources used for food was estimated to be around ST100 million per year.

The coastal marine environment also plays a vital role in other developments such as tourism and is also a source of building material and medicine.



A typical profile of a tropical coastal ecosystem showing the distribution of fish and other marine species [Source: King and King, 1995]

MARINE FLORA

Mangroves and seagrasses form important components of the marine flora. However, these were discussed in last week's edition under "Marine Habitats and Ecosystems"

Marine Algae

Marine algae consist of a large and diverse group of primarily plantlike organisms. They use photosynthesis to obtain their food. They vary in form from small, single to complex multicellular forms such as the giant kelps of the eastern Pacific that grow to more than 60 meters in length and form dense marine forests. Marine algae play very important roles in the marine environment in that they are primary producers thus forming the base of the

food chain, provide oxygen for other aquatic life, coralline algae cement coral reefs and contribute to economic well-being in the form of food, medicine and other products.

Recent surveys reveal that a total of 287 species of marine algae are found in Samoa. In the Palolo Deep alone, 128 species of algae have been recorded, of which 89 are new records. In addition, 4 of the algae recorded in Palolo Deep are new species of which 1 is only found in Palolo Deep. There are three species of algae in Samoa that are consumed by people, the seaweeds *Caulerpa racemosa* [limu fuafua], *Caulerpa* sp.[limu fuafua], and *Halymenia durvillei* [limu aau]. Two species of seaweeds have been introduced into Samoa for aquaculture trials. These are *Kappaphycus alvarezii* and *K. denticulatum*. The status of these introduced seaweeds in our marine environment is unknown.

MARINE FAUNA

Mammals

Mammals are warm-blooded animals that give birth to live young. The young mammals rely on their mothers for food and stay with them until they are ready to fend for themselves. Marine mammals found in Samoa include whales and dolphins [cetaceans] which fall under two large groups, those with teeth [toothed cetaceans] and those which do not have teeth but have baleen [comb-like structures used for filtering food].

Several whale species and a dolphin species have been recorded in Samoa's water. The whale species include 2 baleen whales and 3 toothed whales. The Baleen whales recorded in Samoa include the Humpback (*Megaptera novaengliae*) and Minke whale (*Balaenoptera acutorostrata*). However Bryde's whale (*Balaenoptera edeni*) is most likely to be also found in Samoan waters. Toothed whales recorded in Samoa's waters are the Sperm whale (*Physeter macrocephalus*), Short-finned pilot whale (*Globicephala macrorhynchus*) and the False killer whale (*Pseudorca crassidens*). The Killer whale (*Orcinus orca*) is most likely to also occur in Samoa. There is only 1 definite species of dolphin that is found within our waters, the Spinner dolphin (*Stenella longirostris*), which is commonly seen in certain areas around the country. Other dolphin species that are likely to also occur in our waters include, the bottlenose dolphin (*Tursiops truncatus*) and the Pantropical spotted dolphin (*Stenella attenuata*).

Populations of both the humpback and sperm whales throughout the world are considered to be in vulnerable status.

Marine Reptiles

Marine reptiles are cold-blooded, egg-laying animals such as turtles and sea snakes. They have tough skin covered with scales or plates.

Three species of turtles have been recorded in Samoan waters of which two are more common. The two common species are the Hawksbill turtle (*Eretmochelys imbricata*) and the Green turtle (*Chelonia mydas*) with the rare one being the Leatherback turtle (*Dermochelys coriacea*). The Hawksbill turtle is the only turtle which has established rookeries or nesting grounds in Samoa with the Aleipata Islands of Nuutele and Nuulua being the most important nesting areas. The Green turtle is known to only feed within our waters. Turtles have been an important part in the traditional Samoan way of life, featuring in legends, myths and songs. In the past, turtles were considered sacred (i'a sa) and were only hunted for special traditional ceremonies such as important matai title bestowments and other important events.

Today all marine turtle species are listed in Appendix 1 of the Convention on International Trade in Endangered Species of Wild Fauna and Flora [CITES]. This means all turtle species are endangered worldwide and if international trade of these species are not eliminated then they may become extinct. Turtle numbers have slumped in the past decades and are still declining due to over exploitation for their meat (food) and shell, habitat destruction, entanglement in fishing nets and other debris, and harvesting of eggs from nests. One

factor also contributing to declines of turtles in Samoa is due to the collapse of most village laws which “regulate” the harvesting of this sacred fish in the past. This, together with modern day fishing equipment and speed boats have resulted in unsustainable harvesting.

Two species of sea snakes have been reported to inhabit Samoa’s waters, the banded sea snake (*Laticauda* sp.) and *Pelamis ploturus*. However, it is likely that there are more than two sea snake species found in Samoa. Little information is known about their status in our waters.

Finfish

Fishbase™ [a software programme developed by the International Centre for Living Aquatic Resource Management-ICLARM] lists 26,710 finfish species known. Of this total 12,848 are listed as primarily marine, 11,311 primarily freshwater and 2,553 brackish or diadromous.

Fresh-water: No detailed study has been conducted on fresh-water fish species occurring in Samoa. However, FishBase™ lists 31 fresh-water fish species recorded in Samoa of which 26 are native species while 5 are introduced. There are actually 6 introduced fresh-water fish species with the recent introduction of another species of tilapia. Of the 26 native fresh-water species listed, at least 3 are also listed as marine/brackish-water fish species.

Marine

Earlier writers referred to Samoa’s fish fauna as one of the richest on the globe. Apart from fresh-water fish species, the marine fish species in Samoa can be categorized as nearshore and offshore fishes. The nearshore fish species comprise of those associated with nearshore reefs, lagoons and mangrove areas whereas offshore fishes can be divided into the deep bottom-dwelling species and pelagic species. A total of 991 fish species have been recorded in Samoa of which 890 are considered shallow-water or reef-inhabiting species [generally at depths <60 m], 56 deep-water bottomfish species [at depths 60-500 m] and 45 pelagic [surface] species. It has also been reported that about 40 fish species are known only from Samoa although FishBase™ does not record any endemic fish species from Samoa. There is a belief that it is likely that there are more endemic fish species in Samoa than those recorded.

Marine fish species form the major portion of the local subsistence, artisanal and commercial fisheries.

A survey report in 1991 indicated reduction in biomass and size of fish in shallower and more heavily fished areas, while high biomass was found in less fished and deeper reef slopes. A survey on reefs and reef slope reported in 1996 also showed this trend where fish species richness increased with depth. Several important food fish species in Samoa are known to have declined in numbers. Declines in fish stocks are attributed to over-fishing and destructive fishing practises which include the use of destructive fishing methods and fishing that target juveniles or spawning migration. Natural factors and phenomenon also contribute to loss or declines of fish stocks

Marine Molluscs

Animals that belong to the mollusc phylum are diverse but “are related by being soft bodied with organs covered by a sheet of tissue called the mantle”. Although the most obvious characteristic of molluscs is often one or two shells secreted by specialized cells in the mantle, not all molluscs have shells. There are more than 50,000 species of living molluscs in the world.

Recent update of the compilation of marine molluscs data indicate a preliminary count of about 788 species of marine molluscs recorded in Samoa. These species fall under 4 Classes (Bivalvia, Cephalopoda, Gastropoda, Polyplacophora), 6 Subclasses, 16 Orders, and 99 Families.

Bivalvia

Bivalves are characterized by two shells [valves] that are hinged on the animal's dorsal surface and include animals such as Clams, Oysters, Scallops, Mussels and Cockles. The most common bivalves found in Samoa include giant clams [faisua], oysters (thorny oyster [fatuaau] and rock oyster [tio]), venus shell [tugane], ark shell [pae], coconut scraper cockle [matatuai/asi], hardshell clam [pae?], pen shell [fole], surf clam [li], sand cockle [pipi].

Two species of native giant clams, *Tridacna squamosa* and *T. maxima*, exist in Samoa. *T. squamosa*, has been considered to be functionally extinct. A third species, *Hippopus hippopus*, is believed to have existed in Samoa before but became locally extinct. This species has been re-introduced. In addition two other giant clam species, *T. derasa* and *T. gigas*, have been introduced into Samoa.

Gastropoda:

Most gastropods have a single, usually spirally coiled shell into which the body can be withdrawn. However some gastropods have either lost or have reduced shells. Animals in this Class include snails and slugs. The important gastropods used for food in Samoa include the topshell, *Tectic pyramis* [aliao] and the turban shell, *Turbo chrysostoma* [alili]. One source listed another species of topshell and four other of turban shells to be found in Samoa. These require confirmation. Other common gastropod species found in Samoa include, the spider conch [*Lambis lambus* - palaau], various cowries including the tiger cowry [*Cypraea tigris* - pule uli], the giant triton or Pacific trumpet shell [*Charonia tritonis* - foafoa], stromb [*Strombus gibberulus* - panea] and the trumpet shell [*Cassis cornuta* - pu]. The most commonly known sea slug in Samoa is the green seahare [*Dolabella auricularia* - gau]. Several other species of sea slugs have been recorded in Samoa. Two species of marine gastropods have been introduced into Samoa. These are the trochus, *Trochus niloticus*, and the green snail, *Turbo marmoratus*.

Cephalopoda:

Animals found in this diverse group have foot that lies close to the head. A shell is sometimes present. Most cephalopods have chromatophores, special pigment cells, that allow them to change colour rapidly and have a sac that secretes sepia [an ink-like substance]. This group includes octopus, squids, cuttlefish, nautilus. At least one species of octopus [fee] and cuttlefish [gufee] are found in Samoa. Several literature list the distribution of a few species octopus and squids found throughout the Indo-Pacific region and in tropical seas.

Polyplacophora:

This class includes animals known as chitons, which are flattened, elongated animals with eight overlapping dorsal shell plates or valves bordered by a thick girdle formed from the mantle. Most chitons are small except for one species that reach 30cm in length. All chitons are marine with most species living in the rocky intertidal zone. There are currently around 600 species known in the world. Ten species of chitons have been recorded in Samoa with two having Samoa as their type locality. One species has been described as a new species and two species may be endemic to the Samoan archipelago.

Childrens Corner



1) Marine algae play an important role in the marine environment by being?

- [a] primary producers
- [b] secondary producers
- [c] tertiary producers

2) Two of the three species of algae consumed by Samoan people are?

- [a] *Kappaphycus alvarezii* and *Amansia paloloensis*
- [b] *K. denticulatum* and *Ceramium kramerii*
- [c] *Caulerpa racemosa* and *Halymenia durvillei*

3) There are _____ species of algae found in Samoa, with _____ being introduced for aquaculture.

- [a] 128, 2
- [b] 287, 4
- [c] 287, 2

4) Whales with teeth are called?

- [a] baleen whales
- [b] toothed whales
- [c] beluga whales

5) Which statement is TRUE about documented cetaceans found in Samoa?

- [a] There are 3 baleen whales, 2 toothed whales & no dolphins.
- [b] There are 2 baleen whales, 3 toothed whales & 3 dolphins.
- [c] There are 2 baleen whales, 3 toothed whales & 1 dolphin.

6) Which species of turtle has established rookeries/nesting grounds in Samoa?

- [a] Green turtle
- [b] Hawksbill turtle
- [c] Leatherback turtle.

7) All marine turtles are listed under what convention?

[a] Convention of migratory species (CMS)

[b] Convention on Biological Diversity (CBD)

[c] Convention on International Trade in Endangered Species of Wild Fauna & Flora (CITES)

8) Areas which are largely over-fished show

[a] A reduction in sizes and biomass of fish caught

[b] An increase in number of marine species

[c] A high biomass and average sizes of fish caught

9) Bivalves common in Samoa include?

[a] giant clams and oysters

[b] giant squids and pen shell

[c] venus shell and turbo shell

10) Which animal moves by shooting out a stream of water and known for secreting sepia?

[a] humpback whale

[b] octopus

[c] jellyfish

11) What is the Samoan word for the ink-like substance secreted by octopus?

[a] vaitusi

[b] pefu

[c] taelama

12) How many species of chitons are recorded in Samoa?

[a] 650

[b] 10

[c] 22

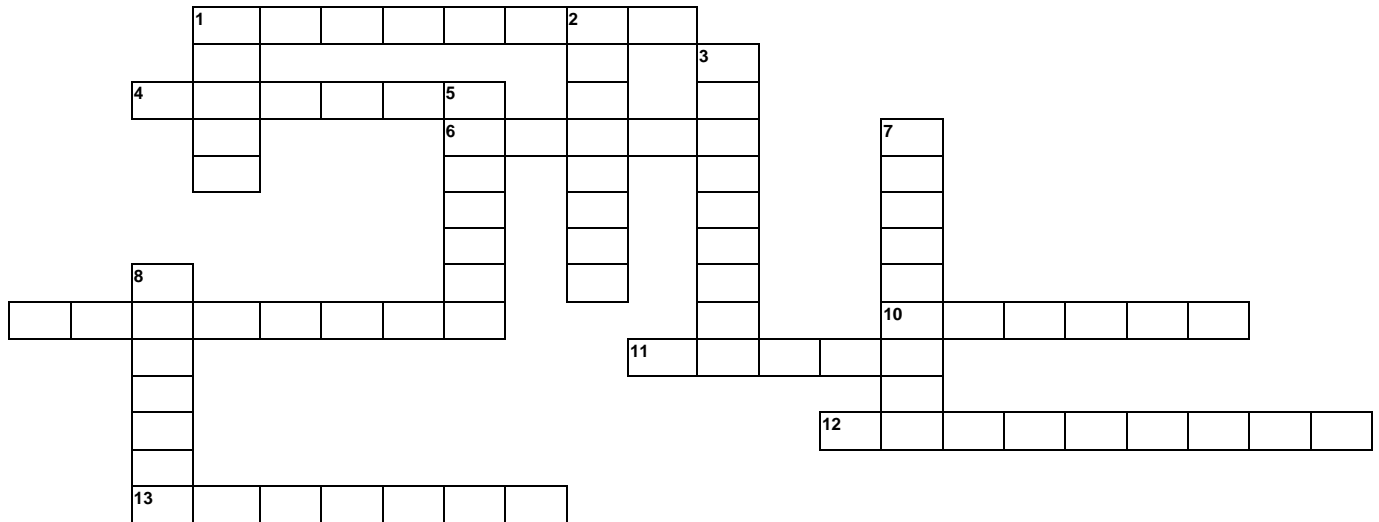
Word Find

FIND THE FOLLOWING WORDS

Clownfish	Dolphin	Lobster	Shark	Urchin
Crab	Fish	Octopus	Starfish	
Coral			Seahorse	
Coral reef	Jellyfish	Palolo	Sponges	
			Seagrass	

F	C	P	L	S	L	Y	R	E	T	S	B	O	L	R
E	K	L	U	D	E	S	S	A	R	G	A	E	S	J
E	A	C	O	B	U	G	I	X	S	A	F	V	W	A
R	Y	R	B	W	E	A	N	J	Y	H	C	S	H	W
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O	Z	H	S	I	F	T	C	S	I	E	X	N	L	P
C	E	C	X	H	T	T	I	F	H	H	S	A	F	P
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Z	N	O	X	P	Y	A	D	D	C	I	O	A	C	I
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O	B	S	L	S	Y	L	R	E	H	H	A	C	N	M
K	S	E	J	A	E	A	K	K	A	F	E	M	R	U
I	J	B	R	O	L	O	L	A	P	E	S	A	N	U

CROSSWORD PUZZLE



CLUES:

Across

- 1) A small marine animal with a head that looks like a horse.
- 4) Samoa's seafood delicacy (marine worms).
- 6) Hard as stone and home to lots of sea animals
- 9) They look like flowers but is a soft animal that catches prey with its many tentacles.
- 10) An animal that carries its shell on its back.
- 11) A sea animal that looks like a fish but is really a mammal that breathes air.
- 12) Trees that grow in muddy grounds between the land and the sea.
- 13) A small playful mammal starred as Flipper.

Down

- 1) A large ocean fish with sharp teeth and tough skin.
- 2) This animal has 5 arms and a body the shape of a star.
- 3) This animal has a soft rounded body that looks like and feels like jelly.
- 5) A sea animal that has a soft body with 8 parts that look like arms.
- 7) Unpleasant fish poisoning you get from eating fish.
- 8) A make believe sea creature with the upper body of a woman and a fish tail.

DID YOU KNOW CORNER?

OCEAN

Under the oceans are mountains higher than Mount Everest, canyons deeper than the Grand Canyon and the largest living structure on earth, Australia's Great Barrier Reef.



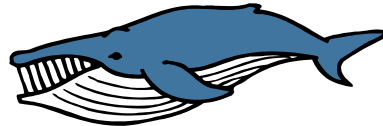
WHITE SHARK

Some sharks have 1,000 or more teeth in orderly rows that are replaced as needed.



HUMPBACK WHALE

The most musical animal under the sea is the male humpback whale, whose unique songs evolve over time.



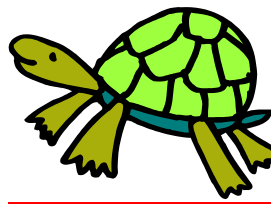
GROUPER

Some groupers gather in numbers as large as 10,000 to spawn, usually around full moons at the same places each year.



HAWKSBILL SEA TURTLE

Since 1900, the worldwide population of hawksbills has declined by more than 80%, largely due to the trade in their beautiful shells.



GIANT KELP

Giant kelp has no roots, yet can grow to 200 feet, and is the world's largest and fastest growing plant in the sea.

