Appendix 1-C. Details of fish species caught for domestic consumption, exported invertebrates, and coastal fishing methods in the Pacific Island region

Fish species caught for domestic consumption

Pacific islanders consume a wide variety of reef fishes, including snappers (Lutjanidae), emperors (Lethrinidae), groupers (Serranidae), parrotfishes (Scaridae), mullet (Mugilidae), surgeon fish (Acanthuridae), trevallies and jacks (Carangidae), and other nearshore pelagic species such as scads (Carangidae), tunas and mackerels (Scombridae). They also consume small species such as squirrelfishes (Holocentridae), hawkfishes (Cirrhitidae) and some of the smaller surgeon fish species.

The fishes commonly associated with mangroves and estuaries in Melanesia have been investigated by many researchers although much work remains to comprehensively describe the fish fauna of Pacific Island mangrove and estuarine ecosystems.[i]

Species commonly caught in the large estuarine and mangrove areas, primarily in PNG, include barramundi (Centropomidae), catfishes (Ariidae), threadfins (Polynemidae), ponyfishes (Liognathidae), clupeoids (Engraulidae and Clupeidae), jewfishes (Sciaenidae) and grunters (Theraponidae).

Pacific communities also use a great variety of molluscs for food and for their shells and over 1,000 species of shell bearing molluscs have been recorded from the region.[2] In addition, cephalopods such as squids, cuttlefish and octopus are harvested from the nearshore zone. Molluscs that are of significant commercial value in the region include trochus (*Trochus niloticus*), green snail (*Turbo marmoratus*) and black-lip pearl oyster (*Pinctada margaritifera*). All these species are harvested primarily for mother-of-pearl used for button manufacture and furniture inlay. The black-lip pearl oyster is also valuable for the production of pearls.

There are an estimated 300 species of shallow water holothurians in the Indo-Pacific region that account for about 27% of the echinoderm fauna in the Pacific islands.[3] Holothurians form part of the subsistence diet of many Pacific islanders, although certain species are commercially valuable as a dried product (known as beche-de-mer, or trepang), that is exported, mainly to Asia. There are at least 22 species of holothurians which are caught for beche-de-mer production in the region, and these belong to the genera of Actinopyga, Holothuria, Stichopus, Theloneta and Bohadschia.[4]

Pacific Island communities also consume a variety of crustaceans found in the nearshore zone including crabs, lobsters and shrimps. The mud crab (*Scylla serrata*) is widely distributed in the region, and this is caught for commercial sale as well as for subsistence. Other reef-dwelling crabs such as the three-spot reef crab (*Carpilius maculatus*), the sand crab (*Portunus pelgicus*) and the red crab (*Etisus splendidus*) are also consumed for subsistence. Land crabs, such as the coconut crab (*Birgus latro*), have traditionally been a component of subsistence catches and may be caught commercially, particularly where there is an established or developing tourist industry. Other smaller land crabs such as *Cardisoma carnifex,* and hermit crabs, are a seasonally important subsistence resource.

Several spiny lobster species are found across Oceania. They include *Panulirus penicillatus*, *P. longipes*, *P. versicolor* and *P. ornatus*, found mainly on tropical reefs; and *P. marginatus* and *P. pascuensis* found on subtropical reefs. These, and the related slipper lobsters (Scyllaridae), are captured both for subsistence and commercial purposes. Other crustaceans that are harvested from

the coastal zone include mantis shrimps (*Squilla* spp.), mud lobsters (*Thalassina anomala*) and penaeid shrimps (which supports an industrial scale fishery in the Gulf of Papua).

Over 40 species of penaeid prawns or shrimps have been identified from the waters of PNG but the most abundant is the banana prawn, *Penaeus merguiensis.*[5] Also commonly captured are tiger prawns, *P. monodon* and *P. semisulcatus*, and the endeavour prawns, *Metapenaeus ensis* and *M. demani*. Elsewhere, such as Fiji, *Penaeus canaliculatus* and *Metapenaeus anchistus* are locally abundant[6], while species such as *P. semisulcatus* and *M. ensis*, which are of minor importance in PNG, are found in the lagoon of Tongatapu in Tonga.[7]

Other invertebrates and marine organisms that are regularly consumed across the region include chitons, sea-hares, marine worms and seaweeds. Populations of the marine polychaete worm, *Eunice viridis*, (*palolo* in Samoa and *balolo* in Fiji) undergo periods of mass spawning in coastal waters in the 4th quarter of the year during full moon periods. The gamete bearing segments of the worms rise to the surface where they can be gathered and are regarded as a great delicacy in parts of the Pacific, especially Samoa.

The importance of non-commercial species is the greatest in the western portions of the WCPO, whereas in the east, small-scale fleets often target the same species as industrial fisheries. In addition to the four main tunas, species of pelagic fish of particular importance to small-vessel fleets active in the coastal zones of PICs include: mackerel tuna (*Euthynnus affinis*), frigate tunas (*Auxis* spp), wahoo (*Acanthocybium solandri*), dogtooth tuna (*Gymnosarda unicolor*), Spanish mackerel (*Scomberomorus commerson*), large jacks (*Caranx* spp.), small jacks (*Selar* spp., *Decapterus spp.*), Rainbow runner (*Elagatis bipinnulatus*), barracudas (*Sphyraena* spp.), false trevally (*Lactarius lactarius*), jobfish (*Aprion viriscens*), mahi-mahi (*Coryphaena hippurus*), *Rastrelliger* mackerels, halfbeaks (Hemiramphidae), flying fishes (Exocoetidae), and various mullets (Mugilidae).[8]

Invertebrates harvested for export

Sea cucumbers

The fishery for sea cucumbers, commonly known as beche-de-mer once the animals have been dried, across Oceania is still mainly driven by demand in Chinese markets. It is one of oldest commercial fisheries in Pacific Islands region dating to early 19th century. The fishery has historically been based in the Melanesia, particularly Fiji, Solomon Islands and Papua New Guinea. Recent production estimates are 1,500-2,000 t, (15,000-20,000 t wet weight) harvest from the region annually accounting for 30% of global production.[9]

Beche-de-mer fisheries are characterised by boom-and-bust harvest cycles. Evidence from mid-19th century in Fiji suggests total stock collapse within 10 years of intensive harvesting of nearshore areas. Following stock depletion in nearshore areas in late 1980s, production in Fiji has been maintained by harvesting in remoter outer islands, increasing harvests of low value species, and use of hookah breathing gear to extend diving capacity. This is similar to experience reported for other beche-de-mer fisheries from the region.[10] Size limits, export restrictions and seasonal area closures have been introduced periodically in several countries (PNG, Solomon Islands, Tonga and Fiji) in an effort to avoid stocks being depleted to 'economic extinction' levels.

Trochus

The trochus fishery, dating from the early 20th century, was also initially driven by demand for pearl shell for button manufacture in Asia and Europe. Although the natural range of trochus is confined to western Micronesia and Melanesia it has been successfully introduced to eastern Micronesia and Polynesia.

Between 1,500-2,000 t of trochus is harvested annually mainly by producers in the Melanesian Islands with small occasional fisheries in Micronesia and Polynesia based on introduced trochus populations. Management in Melanesia is restricted to minimum size restrictions. Elsewhere, smaller occasional fisheries are more regulated through a mix of closed seasons, size limits, individual transferable quotas and reserves.[11]

Coastal fishing methods

Coastal fisheries of Oceania are based on the wild capture of a wide range of fish and invertebrate species characterised as low-investment, small-scale, multi-gear, multi-species fisheries. In addition to the change in species diversity moving from west to east across the region, the species contributions to these fisheries arise from the use of different fishing methods, variation in available fish habitats, regional differences in dietary preferences and cultural practices of Pacific Island people.[12,13]

Most coastal fisheries are characterised by small-scale, relatively low cost, fishing methods.[14] A considerable amount of fishing takes place from the shore or in shallow waters without the use of fishing vessels. Where fishing vessels are used, these are generally small canoes and dinghies powered by outboard motors or sails. Larger (8-20m) vessels powered by outboard motors or inboard diesel engines are used for commercial purposes (fishing for demersal species beyond the reef slope and for catching tuna on the open ocean.[15]

Gears include hook and line, traps, nets and spears. Hook and line fishing may include drop lines, bottom and surface long lines, or towed or trolled baits and lures. Traditional hooks and lines fashioned from shell, bone, wood and plant fibre have generally been superseded by metal hooks and mono-filament lines. Commercial drop lines for demersal species (such as snappers and groupers on the deep reef slope), or on banks and seamounts are mounted on reels to aid hauling from depths between 100 and 400m.[16] Bottom long lines have also been used to catch demersal species, particularly in Fiji, where long lines of between 500 and 1,000 hooks are set on off shore banks and seamounts.[17] Pelagic long lines (between 300 and 2,000 hooks) are employed to catch tuna in the open ocean.[18] Gillnetting, beach seining and drive-in netting are conducted both in coralline and estuarine areas of the Pacific.[19] Gillnets and cast nets are also common.[20] Spears may be single or multiple pronged and may be hand launched or propelled using heavy duty rubber attached to the wrist, a crudely fashioned wooden stock or a commercially purchased speargun. Stationary fish traps were historically common features of reef flats and in estuaries in the Pacific region but are in decline as alternative fishing methods replace them. Gleaning across reef flats, seagrass meadows and in mangrove thickets is also responsible for a significant contribution to the subsistence harvest.

Many invertebrates such as molluscs, crustaceans and echinoderms are collected from reefs at low tide by hand with a significant proportion of that harvest undertaken by women and children.[21] More exotic fishing gear employed in coastal fisheries include the “bêche-de-mer bomb”,[22] kites[23] and nooses.[24] Fishing methods most commonly employed to catch aquarium fish include hand nets, small barrier nets and syringe-like “slurp” guns.[25] Certain methods of fishing particularly destructive to fish

populations and marine habitat have been banned in many Pacific islands. For example, the use of dynamite or toxins, such as cyanide and bleach, to kill or stun fish is widely prohibited.[26]

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