The potential for development of fisheries in the Pitcairn EEZ

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Introduction

This report summarises what the Secretariat of the Pacific Community (SPC) knows about fisheries in the Pitcairn Exclusive Economic Zone, both tuna and coastal. It goes on to discuss potential development prospects, and other fishery-related issues that may need to be taken into account.

Pitcairn is a member of the Pacific Community. As an SPC member, Pitcairn has access to natural resource assessment and development advice (fisheries, agriculture and forestry), as well as access to SPC's various social programmes in Public Health, Women, Youth, Culture, Statistics and Demography[2]. SPC projects are pipelined following a request by the Governor of Pitcairn to the SPC Director-General, which itself usually follows an initial round of informal consultation to determine whether the project is achievable within the parameters of the SPC budget and mandate.

SPC has done fisheries work for Pitcairn on several occasions over the course of its 55-year history, and more than one current SPC fisheries staff-member has visited Pitcairn as part of a previous job doing trial commercial fishing at the invitation of the Pitcairn administration. SPC is also the repository for the logsheets of commercial tuna fishing vessels in the SPC Statistical Area, and whilst these logs are only comprehensive for fishing within EEZs[3], there is enough information on fishing in other EEZs and high seas areas around Pitcairn to build up a broad picture of the tuna fisheries and prospects of the area.

The production of this report is governed by a Letter of Agreement jointly signed by SPC and the Pitcairn Administration (Annex 1), and the staff time involved was funded out of the SPC Marine Resources Division budget.

[1] This report was written mainly by Adam Langley and Tim Adams, with notable input based on existing SPC reports, particularly those by Peter Sharples, Paul Dalzell, Lindsay Chapman, Sandy Argue and Bob Kearney.
[2] Note that SPC work does not cover the sectors in which other Pacific Island regional organizations work, such as the environment (SPREP), oceanography and coastal protection (SOPAC), economic policy (PIFS), higher education (USP), tuna fishery management (FFA)
[3] SPC does not hold any logsheets for licenced fishing by tuna vessels within the Pitcairn EEZ

TUNA FISHERIES

The Pitcairn Islands EEZ is located in the central, southern Pacific Ocean and has a total area of approximately 842,000 km^2 (Figure 1) with a total land area of 12.5 km^2. The Pitcairn Islands EEZ shares a common boundary with the EEZ of French Polynesia to the west but most of the EEZ is surrounded by international waters. The Pitcairn Islands EEZ is located outside the existing boundaries of the western central Pacific Ocean (WCPO) (eastern boundary is at 150°W), but part of the eastern boundary of the new WCP Tuna Commission (a vertical line at 130°W) encompasses the western section of the Pitcairn Islands EEZ, an area of approximately 132,000 km^{2,} or approximately 15.7% of the Pitcairn Islands EEZ. The Pitcairn EEZ is however wholly within the IATTC area (Inter-American Tropical Tuna Commission), which extends to 150°W – an overlap with currently unknown political implications, but one that is also faced by French Polynesia and, to a certain extent, Kiribati.

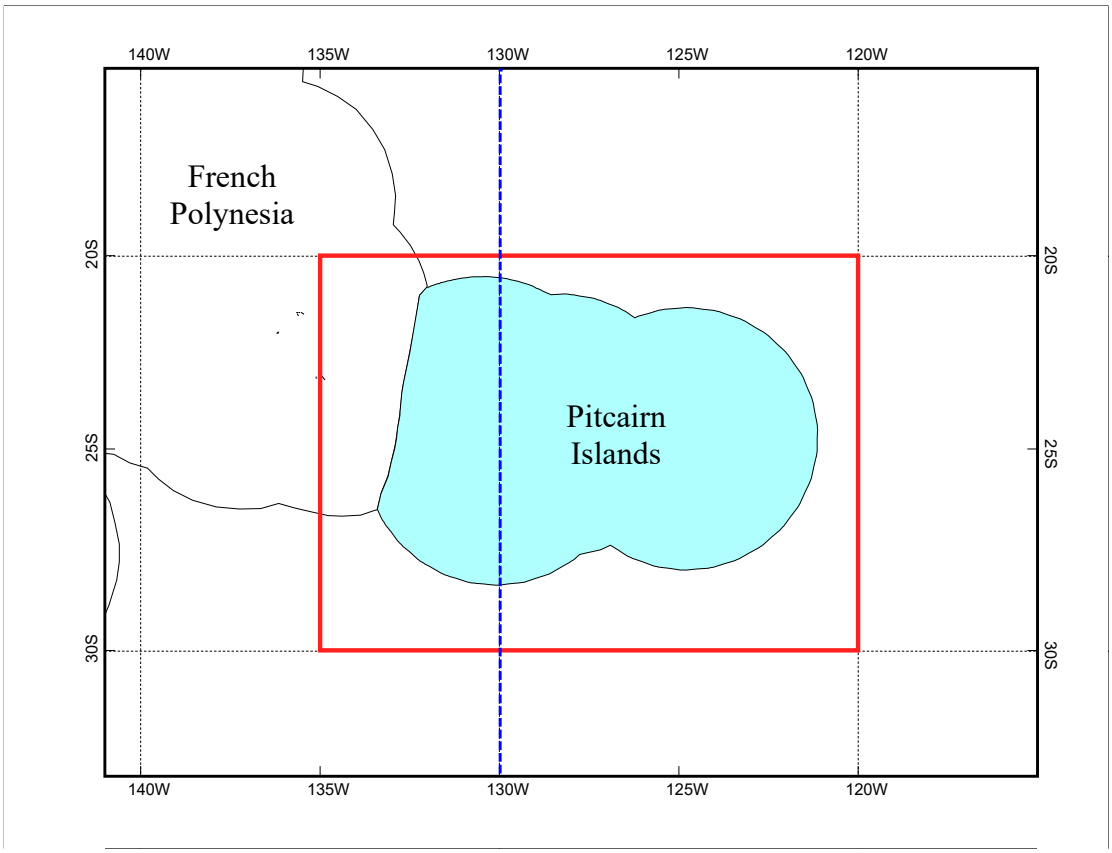

Figure 1: Location of the Pitcairn Islands EEZ (in light blue) and the region used to compile catch and effort data (red box, (20°S–30°S, 135°W–120°W). The dotted blue line represents part of the eastern boundary of the WCPTC. The western boundary of the Pitcairn Islands EEZ shares a common boundary with the EEZ of French Polynesia.

TUNA FISHERY TRENDS

Historically, the tuna fishery in the vicinity of the Pitcairn Islands EEZ is exclusively conducted by the longline fleets of the distant water fishing nations, principally Japan, Korea, and Taiwan. The southerly location of the Pitcairn Islands is well beyond the distribution of the operation of the pole-and-line and purse-seine fleets. A small troll fishery for albacore operates in the south Pacific during summer, although virtually no fishing has occurred in the vicinity of the Pitcairn Islands.

The central Pacific Ocean longline fishery principally operates in the equatorial and sub-equatorial areas (between latitudes 20°S and 10°N) (Figure 2). The catch is dominated by bigeye and yellowfin in the equatorial waters and south Pacific albacore in the more southern latitudes (south of 15°S) (Figure 2). The Taiwanese distant-water longline fleet operates in international waters in the area south of latitude 20°S, including in the vicinity of the Pitcairn Islands EEZ, principally targeting albacore.

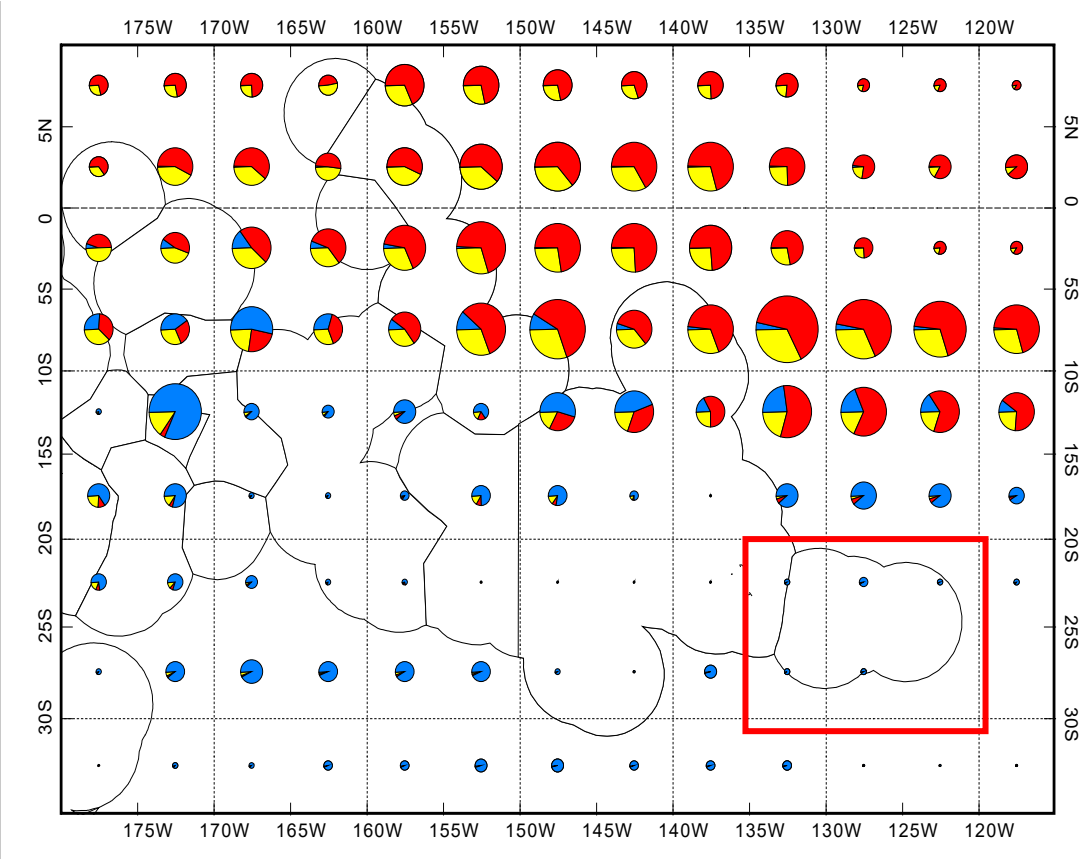

Figure 2: Cumulative longline catch of yellowfin (yellow), bigeye (red), and albacore (blue) from 1990–2003 by 5 degree of latitude and longitude. The area of the symbol is proportional to the cumulative catch with the maximum circle size representing 20,000 mt. The red square depicts the area used to approximate the area of the Pitcairn Islands EEZ.

This section summarises historical trends in catch and effort from the longline fishery to provide an indication of the potential scope for the development of the longline fishery within the Pitcairn Islands EEZ. Catch and effort data by fishing fleet are available aggregated by month and 5° latitude/longitude. For the purpose of this analysis, an area was defined that includes the Pitcairn Islands EEZ and the peripheral areas (20–30°S, 135–120°W, see Figure 2). This area is a total of 1,686,000 km^2 of which 842,500 km^2 (50%) is within the Pitcairn Islands EEZ.

Catch and effort data are available from 1958 to 2004. These data were used to determine historical trends in fishing effort in the area and the species composition of the catch. Data from the last decade were examined in more detail to investigate seasonal trends in the operation of the fishery and the influence of oceanographic conditions on the performance of the longline fishery.

Historical trends

Longline fishing in the vicinity of the EEZ of the Pitcairn Islands commenced in the late 1950s by the arrival of the Japanese fleet (Figure 3). During the mid 1960s, Korean and Taiwanese vessels also operated in the fishery and fishing effort peaked in the 1970s at about 5–8 million hooks per annum, although effort varied considerably between years. Since the late 1970s, there has been no significant fishing activity by the Japanese fleet and the Korean fleet essentially withdrew in the late 1980s. In the subsequent years, the fishery has been dominated by the Taiwanese longline fleet (Figure 3).

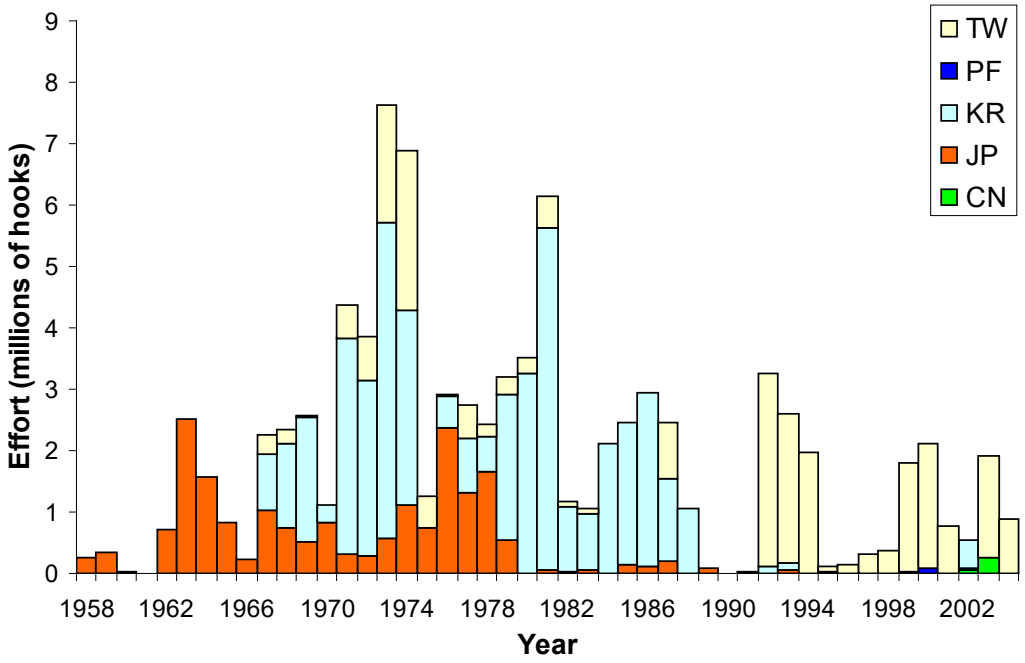

Figure 3: Total longline effort in the vicinity of the Pitcairn Islands EEZ (20–30°S, 135–120°W) by fleet (Fleet codes: TW, Taiwan; PF, French Polynesia; JP, Japan; CN, China). Source: SPC raised database. Data for 2003 and 2004 are incomplete.

Recent longline effort in the vicinity of the Pitcairn Islands EEZ has averaged about 1 million hooks per annum (Figure 3). By comparison, the Taiwanese distant water longline fleets annually sets in excess of 100 million hooks in the southwestern area of the Pacific Ocean.

Reported catches from the longline fishery have been dominated by albacore (*Thunnus alalunga*), particularly by the Taiwanese and Korean fleet. However, significant catches of bigeye (*Thunnus obesus*), yellowfin (*Thunnus albacares*), blue marlin (*Makaira nigricans*), and striped marlin (*Tetrapturus audax*) were also taken during the earlier period of the fishery (Figure 4 and Figure 5). The catch composition from the area varies considerable over time and between fleets. Substantially higher catches of bigeye, blue

marlin, and striped marlin were reported by the Japanese fleet, while the yellowfin represented a significant component of the catch from Japanese and Korean vessels.

By contrast, the Taiwanese catch was dominated by albacore with very low associated catches of the other tuna and marlin species (Figure 4 and Figure 5). The differences in catch composition are likely to be partly due to differences in the targeting practices between fleets (e.g. fishing at different times of the year and using different gear configurations). However, the differences may also be attributable to temporal changes in the abundance of different species or differences in retention and recording of the catch of individual species. In particular, there is concern regarding the reliability of reported catch of species other than albacore by the Taiwanese fleet.

Nevertheless, even during the peak of the fishery in the 1970s, the annual reported catches of these other species was relatively minor (bigeye about 250 mt; yellowfin 100 mt; blue marlin 50 mt; striped marlin 200 mt) (Figure 4 and Figure 5). There was also substantial inter-annual variation in the catch of each species and some years yielded very high catches for a single species (e.g. yellowfin in 1980; blue marlin 1963; striped marlin 1976).

Albacore catches also varied considerably between years, ranging from less than 100 mt to over 1,500 mt (Figure 4). There is a weak cyclical trend in the annual catches with three–four years of higher catches followed by several years of low catches. For example, higher catches of albacore were taken in 1971–74, 1979–81, 1986–87, 1991–94, and 1999–2000, while low catches were taken in 1969–70, 1975–76, 1982–83, 1989–91, and 1995–98 (Figure 4).

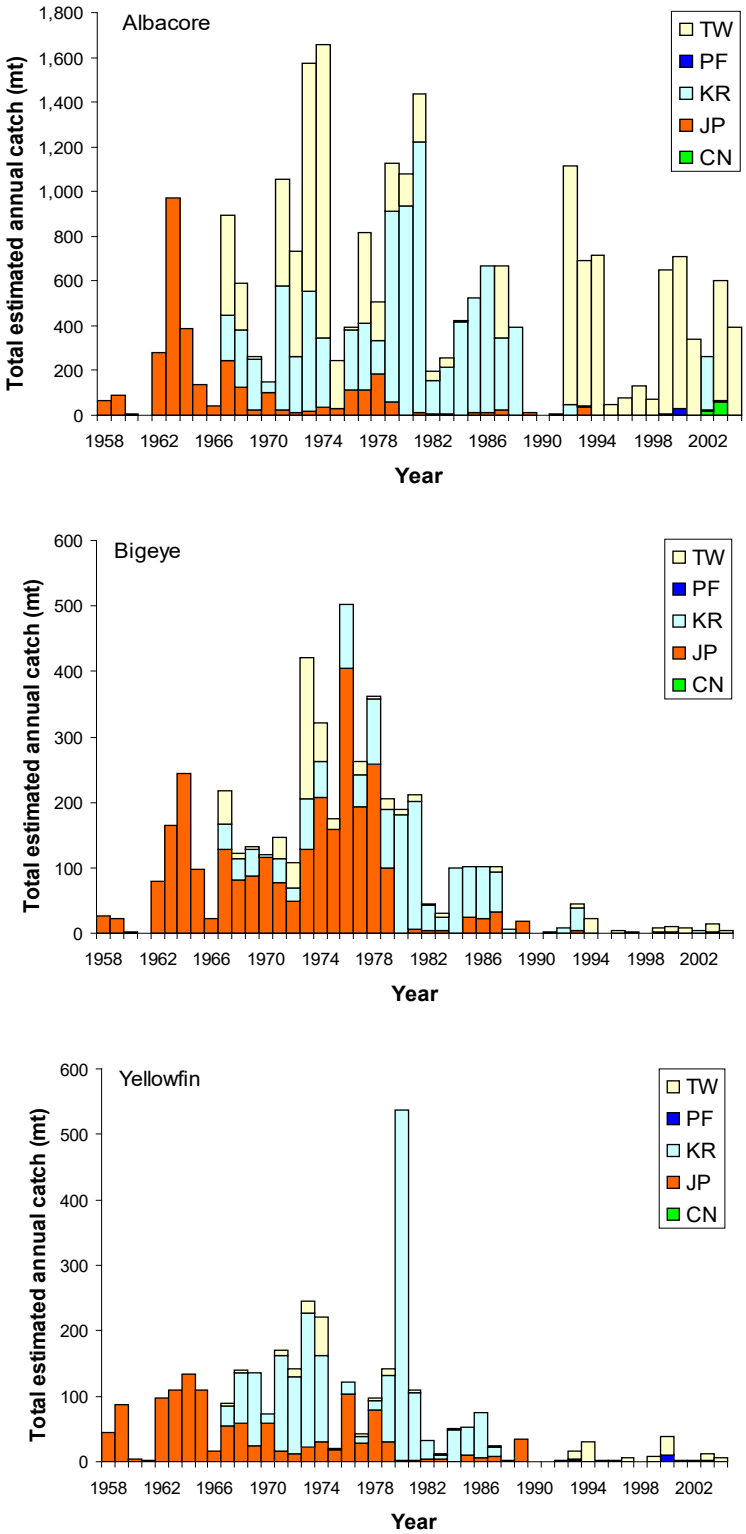

Figure 4: Estimated annual catches of major tuna species by longline fleets operating in the vicinity of the Pitcairn Islands EEZ (20–30°S, 135–120°W) (Fleet codes: TW, Taiwan; PF, French Polynesia; JP, Japan; CN, China). Source: SPC raised database. Data for 2003 and 2004 are incomplete.

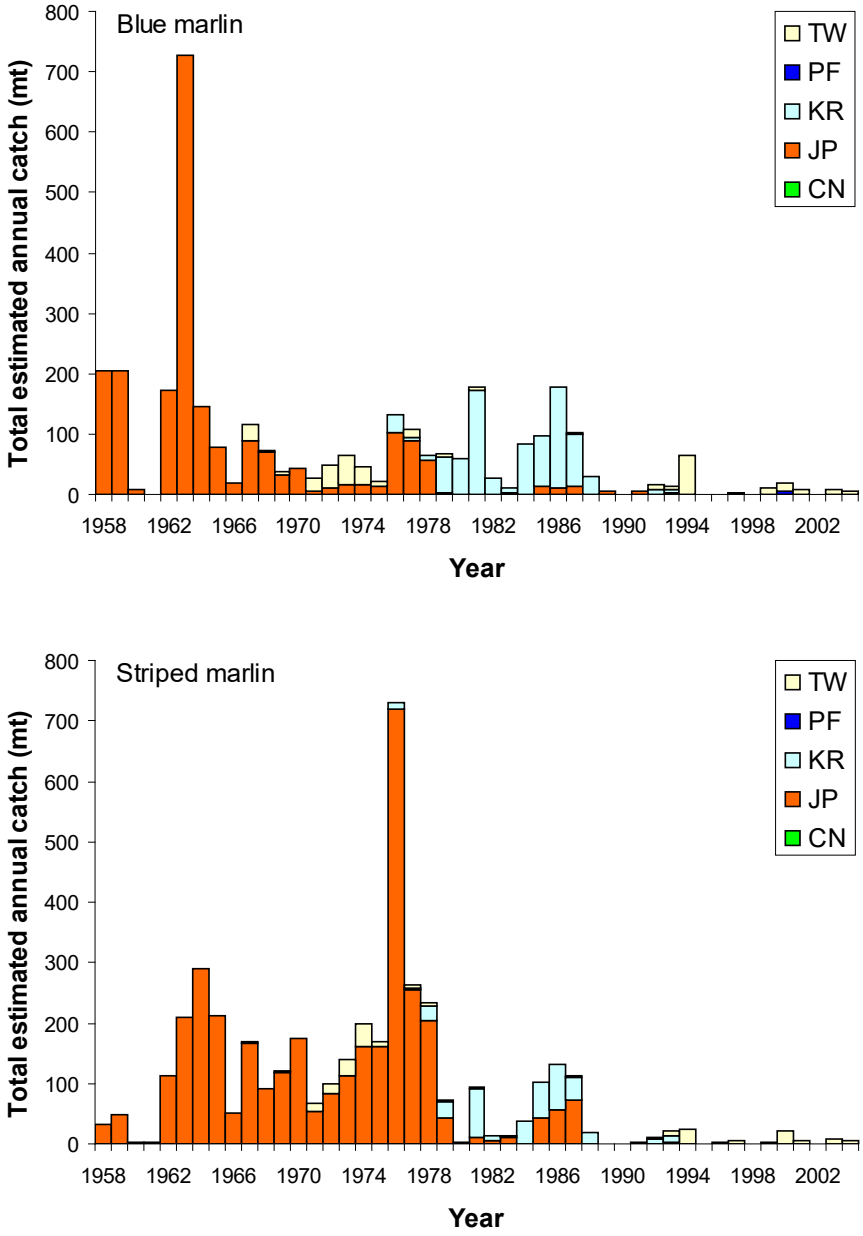

Figure 5: Estimated annual catches of major billfish species by longline fleets operating in the vicinity of the Pitcairn Islands EEZ (20–30°S, 135–120°W) (Fleet codes: TW, Taiwan; PF, French Polynesia; JP, Japan; CN, China). Source: SPC raised database. Data for 2003 and 2004 are incomplete.

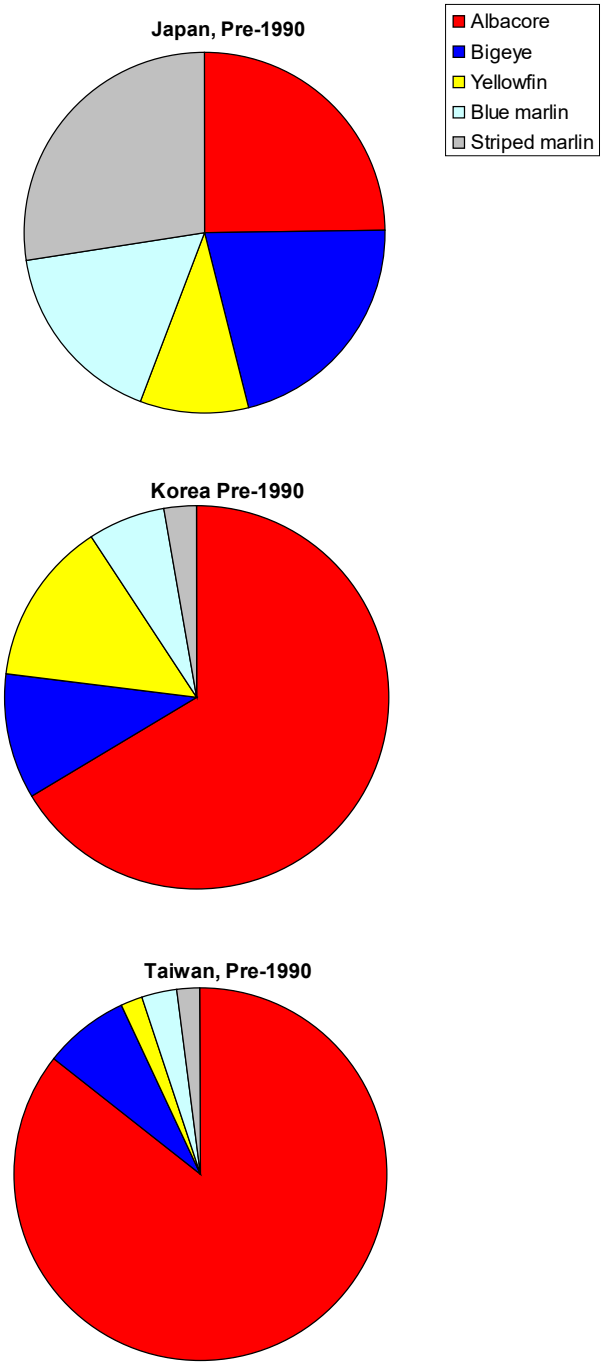

Figure 6: Proportion of species catch (by weight) by the main longline fleets in the vicinity of the Pitcairn Islands EEZ, 1958–1989. Source: SPC raised data.

Catch rates (CPUE)

Albacore catch rates from the longline fishery operating in the vicinity of the Pitcairn Islands EEZ generally fluctuated between 20 and 40 kg per 100 hooks over the entire period of the fishery (Figure 7). This level of CPUE is comparable to the regional average for the longline fisheries operating south of the equatorial region of the south Pacific. Nevertheless, there are considerable differences in the overall catch rate of albacore between the main fleets. The highest CPUE was achieved by the Taiwanese fleet during the 1970s, while albacore CPUE for the Japanese fleet was low (Figure 7).

In contrast, the Japanese fleet achieved relatively high catch rates of bigeye and striped marlin during the late 1960s and early 1970s, while catch rates of both species have been low for the Taiwanese and Korean fleets, particularly in recent years (Figure 7 and Figure 8).

Overall, catch rates of yellowfin were low throughout the history of the fishery, with the exception of higher catch rates achieved by the Japanese fleet in the early years (Figure 7). Similarly, initial catch rates of blue marlin for the Japanese fleet were high but declined rapidly and remained at a low level since the early 1970s (Figure 8).

Differences in the catch rate of individual species between the different sectors of the fleet are likely to reflect differential targeting practices e.g., the high catch rates of bigeye and low catch rates of albacore for the Japanese fleet compared to the Taiwanese fleet. The trends in targeting practice are also likely to develop over time as indicated by the increasing bigeye CPUE of the Japanese fleet during the 1960s and 1970s. However, over the history of the fishery there are also likely to have been changes in the resource abundance both at a regional scale and a local scale that will influence the observed trends in catch rate.

Consequently, given that the fishery is now dominated by a single element of the fleet principally targeting albacore, it is difficult to reliably predict the level of CPUE that could be achieved using different targeting practices. For example, of specific interest is the high level of CPUE of bigeye achieved by the Japanese longline fleet. However, this sector of the fleet is no longer operating in the area and, therefore, it is unknown whether the current resource is able to sustain the higher levels of CPUE previously achieved from a targeted longline operation.

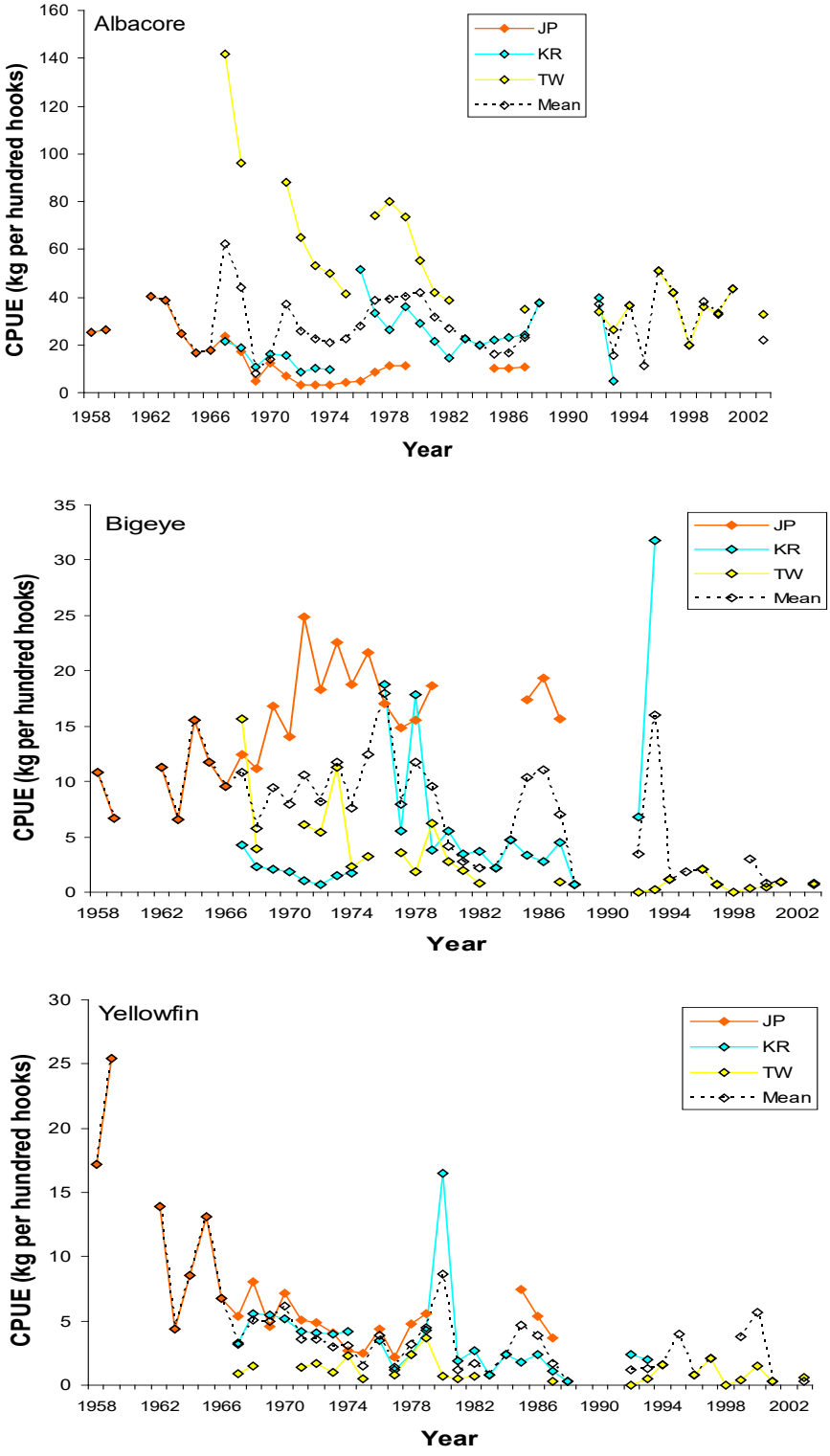

Figure 7: Catch per unit effort (CPUE) of major tuna species by longline fleets operating in the vicinity of the Pitcairn Islands EEZ (20–30°S, 135–120°W) (Fleet codes: TW, Taiwan; PF, French Polynesia; JP, Japan; CN, China). Only fleet/years with more than 100,000 hooks set are included. Source: SPC raised database. Data for 2003 are incomplete.

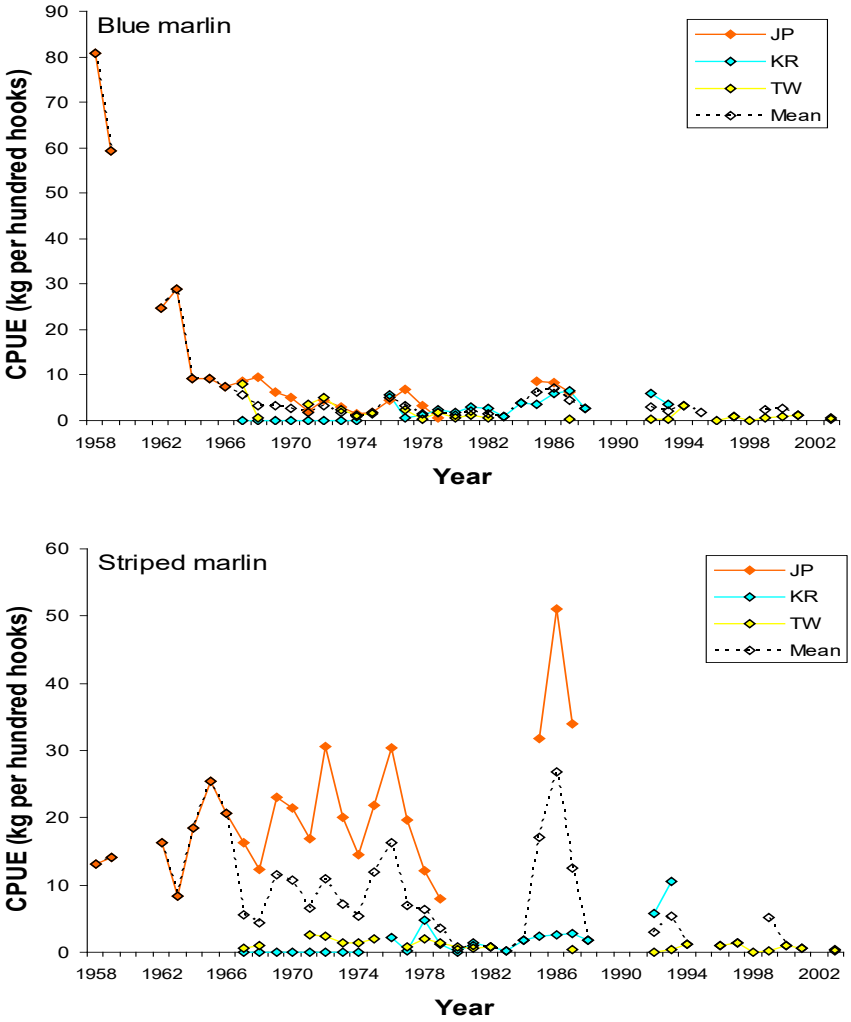

Figure 8: Catch per unit effort (CPUE) of major billfish species by longline fleets operating in the vicinity of the Pitcairn Islands EEZ (20–30°S, 135–120°W) (Fleet codes: TW, Taiwan; PF, French Polynesia; JP, Japan; CN, China). Only fleet/years with more than 100,000 hooks set are included. Source: SPC raised database. Data for 2003 are incomplete.

Recent Fishery

Since 1990, longline fishing activity in the vicinity of the Pitcairn Islands EEZ has been dominated by the Taiwanese distant-water fleet. There has also been limited fishing activity by Japan, Korea, French Polynesia, and most recently, China (Table 1). The overall level of fishing activity has also varied considerably between years, peaking in the early 1990s, low during the mid 1990, and relatively high during 1999–2003 (Table 1).

Table 1: Annual number of hooks set (millions) by fleet nationality in the area approximating the Pitcairn Islands EEZ (-, denotes no fishing; NA denotes incomplete data). Source: aggregated data held by SPC, recent data from Taiwan and Korea are not available.

				Fleet		Total
Year	China	Japan	Korea	French Polynesia	Taiwan	
1990	-	-	-	-	0.08	0.08
1991	-	0.10	-	-	0.00	0.10
1992	-	-	0.12	-	3.12	3.25
1993	-	0.05	0.10	-	2.48	2.64
1994	-	-	-	-	1.96	1.96
1995	-	0.00	-	0.02	0.10	0.12
1996	-	-	-	-	0.19	0.19
1997	-	-	-	-	0.36	0.36
1998	-	-	0.00	-	0.37	0.37
1999	-	0.00	0.01	0.01	2.06	2.08
2000	-	-	-	0.10	2.31	2.40
2001	-	-	0.01	-	1.69	1.69
2002	0.07	0.16	NA	-	NA	NA
2003	0.33	-	NA	0.00	2.12	NA

Reported catches of tuna species in the area have fluctuated relative to the annual level of fishing effort, ranging from very low levels (less than 100 mt) to a maximum of about 1,100 mt during 1990–2003 (Table 2). Over this period annual catches have averaged about 470 mt.

The catch has been dominated by albacore (95%) with small associated catches of yellowfin (2%) and bigeye (3%) (Table 2). The Japanese and Korean fleets have recorded a high proportion of bigeye in the catch in some years, although overall bigeye catches were small (less than 50 mt per annum).

Table 2: Annual longline catch (mt) by species and species composition in the area approximating the Pitcairn Islands EEZ. Data from 2002 and 2003 are incomplete.

Year	Catch (mt)			Percent composition		
	ALB	YFT	BET	ALB	YFT	BET
1990	29	0	0	100.0%	0.0%	0.0%
1991	10	5	6	48.4%	22.9%	28.7%
1992	1,114	3	9	99.0%	0.3%	0.8%
1993	691	16	45	91.8%	2.1%	6.0%
1994	717	30	22	93.2%	3.9%	2.8%
1995	49	2	1	94.9%	3.8%	1.3%
1996	104	1	3	95.7%	1.3%	3.0%
1997	169	7	7	92.1%	4.0%	3.9%
1998	74	0	0	99.0%	0.3%	0.6%
1999	779	8	10	97.7%	1.0%	1.2%
2000	924	40	15	94.4%	4.1%	1.5%
2001	599	10	28	94.1%	1.5%	4.4%
2002	60	5	51	51.9%	4.0%	44.1%
2003	836	13	17	96.5%	1.6%	2.0%
Total	6,155	142	214	94.5%	2.2%	3.3%

The Taiwanese fleet mainly operates in the vicinity of the Pitcairn Islands EEZ during the austral spring and summer (October–March), although the fishing season was more protracted in some years (e.g. 1994 and 2003) (Figure 9). Limited fishing was conducted in 1995–1997.

During 1990–2003, catch rates of albacore have fluctuated about the long-term average of about 37 kg per 100 hooks (Figure 10). This catch rate is comparable to the catch rate of albacore achieved in other subequatorial EEZs where the Taiwanese fleet has operated during the same period (including Tonga, Fiji, Niue, Cook Islands, and Vanuatu).

The operation of the Taiwanese fleet in the vicinity of the Pitcairn Islands EEZ generally coincides with south-eastern movement of warmer water into the area during spring (Figure 11). This is indicated by the movement of the 27°C isotherm and corresponds with a strong increase in average sea surface temperatures in the area (Figure 12). The relatively high catches during this period may relate to an increased abundance of albacore associated with the interface between the warmer sub-equatorial water and cooler subtropical water. The level of annual catch may correspond to the strength of this interface and the persistence of the feature within the area of the Pitcairn Islands EEZ.

The low catches in 1996/97, 1997/98, and 1998/99 seasons were preceded by cooler winter sea surface temperatures, while recent higher catches were taken following slightly warmer winter sea temperatures in 1999–2002 (Figure 12).

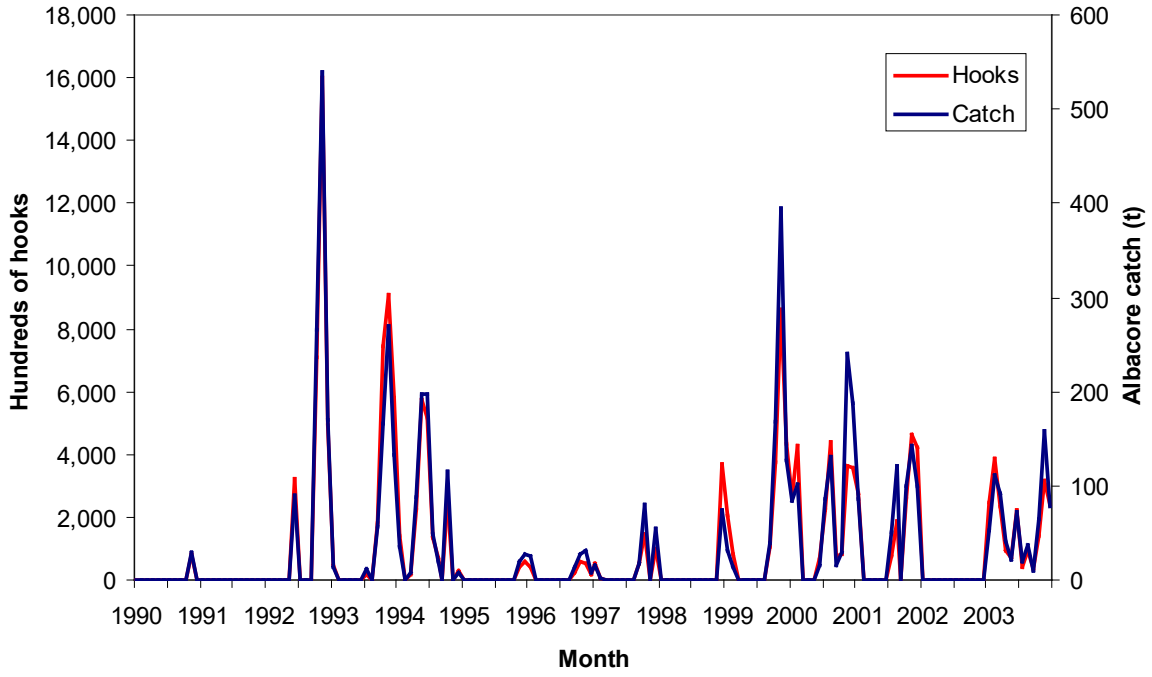

Figure 9: Monthly fishing effort (hundreds of hooks) and albacore catch (mt) by the Taiwanese fleet in the vicinity of the Pitcairn Islands EEZ from 1990 to 2003. Data from 2002 were not available.

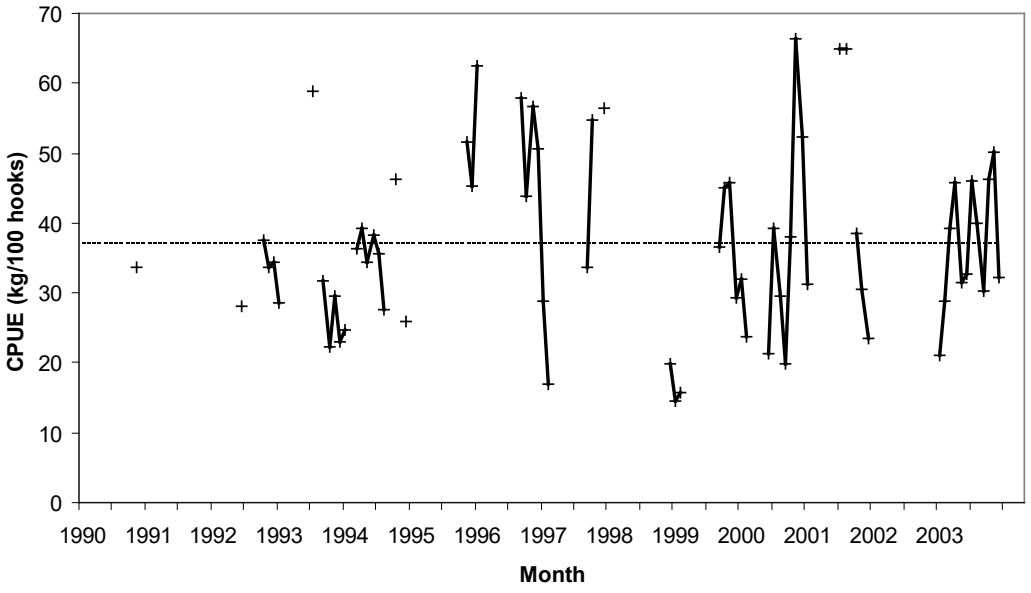

Figure 10: Monthly catch rates of albacore catch (kg per 100 hooks) by the Taiwanese fleet in the vicinity of the Pitcairn Islands EEZ from 1990 to 2003. The dashed line represents the average for the period. Data from 2002 were not available.

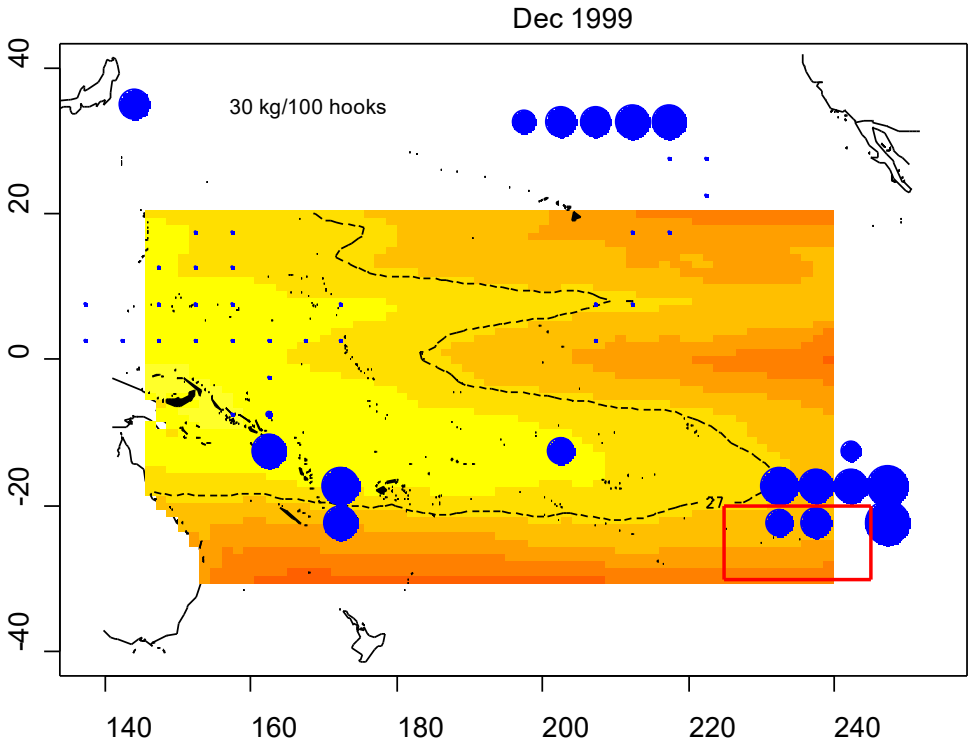

Figure 11: Relative catch rates of albacore for the Taiwanese fleet by 5 degree square (blue circles) during December 1999. The monthly sea surface temperature is also presented (increasing temperature from red to yellow). The dashed line represents the 27°C isotherm.

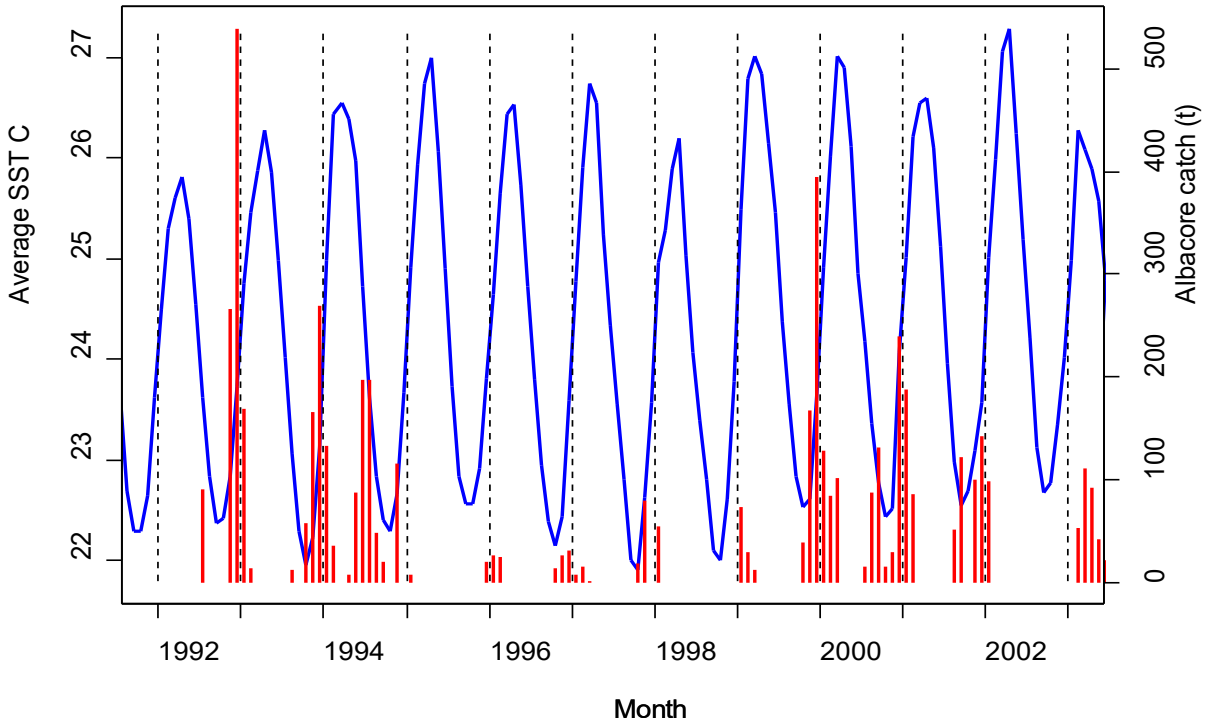

Figure 12: Monthly average sea surface temperature in the area of the Pitcairn Islands (blue line) and monthly catches of albacore in the vicinity by the Taiwanese longline fleet. Data from 2002 were not available.

TUNA STOCK ASSESSMENTS

Albacore

The Oceanic Fisheries Programme of SPC has undertaken a stock assessment of South Pacific albacore. The assessment is sub-divided into three subregions that extend across the South Pacific Ocean.

Annual catches from the South Pacific albacore stock have approached 60,000 mt in the last few years. Most of the catch is taken by the longline method, although modest catches are also taken from the troll fisheries operating around New Zealand and in the Subtropical Convergence Zone (STCZ).

The recent stock assessment of South Pacific albacore indicates that the current exploitation rates are very low, i.e. the stock is lightly fished and the biomass is at a level well above B_{MSY}[4]. Consequently, significantly higher yields are available from the stock. For more details, see http://www.spc.int/OceanFish/Html/SCTB/SCTB16/alb1.pdf.

Yellowfin

Annual stock assessments of yellowfin are conducted for the western and Central Pacific Ocean (WCPO) and eastern Pacific Ocean (EPO). The boundary of the two assessment areas is longitude 150°W and, consequently, the Pitcairn Islands EEZ is included within the EPO assessment area. The EPO assessment is undertaken by the Inter-American Tropical Tuna Commission (IATTC), rather than by SPC which is responsible for the WCPO.

Most of the yellowfin catch in the EPO is taken by the purse-seine fishery operating in the equatorial region. Relatively small annual catches are also taken by the longline fishery. Overall, catches of yellowfin are negligible in the south-western area of the EPO — the area encompassing the Pitcairn Islands EEZ.

The current assessment for yellowfin indicates the overall EPO stock is slightly below the level of B_{MSY} and is predicted to increase to a level greater than the B_{MSY} over the next few years. Recent catches have been higher than the MSY level (450,000 mt) due to recent high recruitment. Current levels of fishing effort are predicted to yield catches only slightly lower than the MSY over the next few years.

The stock assessment document is available from the IATTC website (http://www.iattc.org/PDFFiles2/SAR4_YFT_ENG.pdf).

Bigeye

The Pacific stock of bigeye is assessed using the equivalent spatial structure to yellowfin: a WCPO assessment and an EPO assessment. The area of the Pitcairn Islands EEZ is included within the boundaries of the EPO assessment area.

The bigeye catch from the EPO is principally taken by the longline fishery and by the purse-seine fishery fishing on schools associated with drifting FADs. As for yellowfin, catches of bigeye within the south-western area of the EPO are negligible.

The current assessment indicates that adult biomass of bigeye has declined since the late 1980s, but was maintained in recent years by strong recruitment in the mid and late 1990s. Recent recruitment has been low and the stock is predicted to decline sharply over the next few years to well below the B_{MSY} level. Recent catches have exceeded the MSY level (67,000 mt) but are projected to decline sharply, principally for the longline fishery.

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[4] B_{MSY} is the standing stock biomass that generates the maximum sustainable fishery yield (MSY), according to models.

The stock assessment document is available from the IATTC website (http://www.iattc.org/PDFFiles2/SAR4_BET_ENG.pdf).

Other pelagic species

Although other species are captured by longline and other industrial fleets in the south Pacific, information on biology and stock assessments is limited. Consequently, the status of these species is currently uncertain.

Prospects for development of Tuna Fisheries

The longline fishery operating in the vicinity of the Pitcairn Islands is principally a seasonal fishery targeting albacore for a short period during spring–summer. Catches were variable between years, ranging from 50 to 1000 mt per annum. These catches were assumed to be taken from an area outside of the Pitcairn Islands EEZ that is significantly larger than the actual EEZ, although it is likely that some of the catch was actually taken from within the EEZ. Annual catches from the Pitcairn Islands EEZ by the same fleet could be expected to be lower than this level.

The annual level of fishing effort and, therefore catch appears to be strongly influenced by the prevailing oceanographic conditions. The level of fishing effort will also be influenced by the relative catch rates achieved in other areas where the Taiwanese fleet has access (including international waters) as the fleet attempts to maximise daily catches of albacore through the fishing season.

The area of the Pitcairn Islands EEZ is at the southern extremity of the distribution of both yellowfin and bigeye. In recent years, catches of both species have been negligible. However, earlier fishing by the Japanese fleet achieved high catch rates of bigeye during October–December (about 20 kg/100 hooks) from moderate levels of effort (300,000 hooks per month). These catch rates have not been observed from the Taiwanese fleet which principally targets albacore. There may be some opportunity to revitalise the longline fishery for bigeye in the Pitcairn Islands EEZ, although annual catches from the fishery are likely to be small due to the limited fishing season, small size of the EEZ, and southern location of the EEZ relative to the main distribution bigeye tuna.

The stock assessment results indicate that there is potential for expansion of the total catch from the south Pacific albacore fishery, while concerns exist regarding the status of the bigeye stock in both the WCPO and EPO. However, small increases in the catch of bigeye in the area of the Pitcairn Islands EEZ, of the order of 100–200 mt, are unlikely to significantly impact the overall stock.

Based on current and historical trends in the fishery, the Pitcairn Islands EEZ is likely to only support a seasonal tuna fishery and the performance of the fishery is likely to vary considerably between years, with total catches limited by the length of the fishing season and the performance of the longline fishery in other areas. Fishing is likely to continue to be sporadic and variable between years. Consequently, it is most appropriate that the development of a fishery within the Pitcairn Islands EEZ is undertaken through the licensing of distant water vessels operating in the vicinity and with access to other neighbouring EEZs, thereby, enabling the vessels to develop a year-round fishing plan. Such a fleet would be able to optimize the opportunity of catching fish present in Pitcairn Islands EEZ, but have the flexibility to fish in other areas when fish were absent and/or catch rates uneconomic.

The value of such an access arrangement would need to consider of the likely level of catch taken each year, the frequency of "good years", and the relative value of the main constituent species of the catch.

In addition, in recent years there has been increased interest in south Pacific in the development of a longline fishery targeting broadbill swordfish (*Xiphias gladius*). Swordfish fisheries have been established in the south-western Pacific (around Australia and New Zealand) and in the south-eastern Pacific. More recently, swordfish has been targeted by vessels fishing in the waters of Tonga and the Cook Islands. Most of the

catch of swordfish is taken within the 20–40°S latitudinal range and, therefore, the waters of the Pitcairn Islands may represent suitable habitat for the species.

While only negligible catches of swordfish have been taken from the vicinity of the Pitcairn Islands EEZ, the longline operation targeting the species differs considerably from the fishery targeting the main tuna species and, consequently, the potential of the swordfish fishery is unknown. On this basis, it may be appropriate to grant a number of exploratory fishing licenses to target the species within the EEZ and, thereby, assess the potential for development of the fishery.

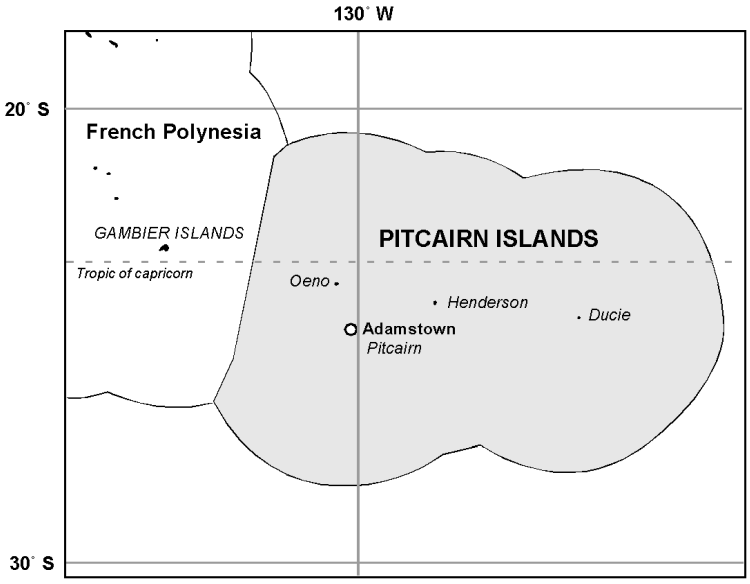
COASTAL FISHERIES

In this section on "coastal" fisheries we consider fisheries that might be undertaken by Pitcairn-based boats (including nearshore tuna fishing) as well as fishing for nearshore and reef species.

A lot of the fishing by Pitcairners is conducted from the shore, as the coast is exposed, and there is no fringing reef around Pitcairn Island.

The small population on Pitcairn Island fish regularly for subsistence and, perhaps surprisingly for such a remote location, for commercial purposes. Several vessels stop by the island each month and provide opportunities for Pitcairners to market fish and carvings. Fishing is conducted on the narrow fringing reefs and reef slope around Pitcairn Island, either from dinghies or from the rocky shore. Almost all fishing is conducted with hand-lines targeting the drummer, *Kyphosus bigibbus* and the grouper *Epinephelus fasciatus* for subsistence, while the red grouper *Variola louti* and the larger eteline snappers on the deep slope are the targets of fishing for sale to visiting vessels.

Pitcairn people use their own freezers for fish storage. There are several imported diesel powered long boats and several small outboard powered skiffs on Pitcairn island (there is no local boatbuilding and only repair work is undertaken locally when needed). Long boats and skiffs are occasional used for trolling tuna and other coastal pelagics.




LandSAT image of Pitcairn Island

Peter Sharples' observer report of the trial fishing trip by two New Zealand vessels in 1994 is appended as Annex 2, and this coastal fisheries section is abbreviated because the Sharples report provides much of the available information. The report illustrates the generally poor prospects for commercial development of sustainable coastal fisheries, and Sharples points out that "The fishable area for most species is limited. Each of the islands fall sharply away from the reef to great depths affording very narrow fishing zones around very small land masses. [The trial fishing operation] made use of gravity variation charts and a variety of other sources of information in an endeavour to find more fishable banks and seamounts like 40-Mile Reef, but to no avail." "…The signs were far from encouraging."

"Bioprospecting"

A list of all the fishes known to be present in Pitcairn waters can be obtained from the definitive on-line "FishBase" encyclopaedia at
http://www.fishbase.org/Country/CountryFishList.cfm?Country=Pitcairn&Group=marine

Unfortunately there is no similarly definitive encyclopaedia for marine invertebrates or other marine species. The potential or actual invertebrate fisheries of Pitcairn are likely to be limited to sea-cucumber (*bêche-de-mer* or *trepang*) and spiny lobster (about which more later).

Pitcairn is no exception to the general rule that species biodiversity declines across the Pacific from West (with the centre of diversity of many groups being in Indonesia) to East. There are far fewer species living in Pitcairn than in, say, the Solomon Islands. This does not mean that the biomass of marine organisms is necessarily less[5], but that this biomass is made up of a smaller number of different types of organisms, with certain species able to dominate ecosystems in a way that they might not be able to assume further west, in more competitive ecosystems.

On the other hand, the genetic biodiversity of the Pitcairn islands is likely to be of some commercial importance because Pitcairn is at the extreme edge of the geographical range of many species, and there is often more genetic variation at the edge of the range, under more extreme conditions and with more isolated subpopulations than at the centre. It is possible that Pitcairn possesses bioengineering- or pharmacologically-useful genotypes that are not found elsewhere on the planet.

SPC is not a repository for marine bioprospecting records, and has no information on any possible expeditions that might have been made to Pitcairn in the past. Such visits are usually by university researchers working under grants provided by pharmaceutical companies looking for compounds that might be active against cancer cells. If marine bioprospecting visits have been made, then the results of these expeditions should be available to the Pitcairn administration (the articles of Marine Scientific Research under the International Law of the Sea are relevant here) and have hopefully been carried out under agreements which would return royalties to Pitcairn in the event of the development of any commercial drugs from active compounds identified from organisms collected in Pitcairn.

Deepwater snapper fishing

An assessment was made of the Pitcairn deep-water snapper resource potential in 1992 by SPC as part of a broader regional assessment, based upon an estimate of the area fishable for deepwater snapper in Pitcairn waters, multiplied by rules of thumb about resource density normally found in other areas, because no catch data was available for Pitcairn. The maximum sustainable yield of deepwater snapper (all species) was estimated to be between 1.1 and 3.3 tonnes per year within the Pitcairn EEZ, which is far below the level needed to support a commercial fishery, but which is appropriate for an artisanal fishery for local consumption and to vary the diet of passing ships.

Commercial fishing trials were later undertaken at all 4 islands and atolls in 1994 for deep-water snappers using droplines, but very low catch rates resulted (Sharples, 1994). It is understood that very little deep-water snapper fishing has been undertaken recently, and this is on an *ad hoc* basis by a couple of boats using handlines (Leon Salt, pers. comm.).

Crustaceans

Undiscovered spiny lobster fishing grounds are one of the most-rumoured fishery "El Dorados" of the South Pacific. The lobster resources of the Pitcairn EEZ have been commercially investigated at least twice within the past 20 years, and these resources are not capable of supporting anything other than a small artisanal fishery – or possibly an isolated commercial "hit" every few years. However, pulse-fishing of this nature is not considered sustainable, by definition, and the commercial harvester would need to be assured that there had been no adventitious poaching by visiting or transiting vessels in the meantime – something which is more likely to happen than not, according to rumour.

[5] Although the biomass of marine organisms almost certainly is less, primarily because of the relative lack of terrestrial nutrient input and the lower ability of small islands to promote much "upwelling" of deep-ocean waters.

Sea Cucumber

Several species of sea cucumbers – Holothurians – can be processed into *bêche-de-mer* or *trepang* by smoke-drying. As with lobsters, the quantities available in the Pitcairn EEZ are likely to be so limited as to be only commercially fishable by occasional trips spaced years apart. Ducie and Oeno are likely to be the most favourable habitats for fishable sea-cucumbers, but Henderson also used to support occasional trips by Pitcairners for bêche-de-mer. Unlike lobsters, processed sea-cucumbers are comparatively non-perishable, and can be stored on shore for trade with passing ships. However, the smoke-drying process requires considerable quantities of wood, and a commercial harvest of sea-cucumber would have effects on the terrestrial environment, particularly significant in a World Heritage site like Henderson.

The problems recently faced by the Galapagos Islands as a result of the bêche-de-mer trade might be noted, although these problems have their roots in a very different social situation to that of Pitcairn.

Approaches have been made to the Pitcairn administration in the recent past by New Zealand-based vessels, but commercial beche-de-mer harvesting is commercially marginal, at best, even in the Cook Islands and French Polynesia, and these approaches have been speculative, and no actual voyage has been reported to SPC. The fact remains that the price of bêche-de-mer continues to rise, and this rise will probably accelerate as the Chinese economy expands (by far the main consumers of sea-cucumber are Chinese-speaking peoples). It is possible that it may become economically feasible to export bêche-de-mer from Pitcairn waters again in the future, but this would never be a large fishery and could probably support only a few individuals at the best of times.

Aquaculture

Fish farming is not considered to be a useful prospect for a group of small islands with limited freshwater supplies and limited human resources. Although small ponds growing, say, Tilapia, might have been useful for protein nutrition in a more overcrowded island, Pitcairners have too ready an access to wild ocean fish to make fish farming useful. The subject is only mentioned here because another form of aquaculture – black pearl farming – is practiced not too far to the northwest, in French Polynesia.

Theoretically, the atolls of Ducie and Oeno could be considered prime real estate by black pearl farmers, who are becoming overcrowded in both the Cook Islands and French Polynesia. However, these black pearl growing sites are valuable primarily because they already hold large numbers of naturally-occurring pearl shells, and produce a copious natural spatfall as well as signalling prime habitat. The Pitcairn atolls are too far south to have dense natural stocks of the blacklip pearl oyster, *Pinctada margaritifera* and such has certainly not been reported by any visitors. However, although it would be a major undertaking for any investor, with a long lead-time before possible profits, it is perhaps possible that these lagoons could be artificially seeded with blacklip pearl oysters. The most likely source of expertise and interest (if any) would be French Polynesia, and, if the prospect of a exclusive pearl-farming rights to a virgin lagoon interests anyone, it may be possible for a black pearl farmer to look at the prospects during the course of a French patrol boat visit. However, the world market for black pearls is currently depressed and this would not be a good time to investigate such a speculative possibility.

Other untested fisheries

Occasionally, a New Zealander will make a foray into the tropical Pacific looking for Orange Roughy or its relatives. These fish are found in very deep water and caught by trawling. Although they are slow-growing and thus not particularly resilient to heavy fishing, the fact that they are found on the ocean floor means that they can be found over quite large areas compared to the very restricted coastal fisheries of small islands. However, nobody has ever proven a commercially-viable deepsea fishery in the tropical Pacific (except perhaps for some beds of precious coral in the North Pacific) despite numerous (mainly unreported – nobody likes reporting a failure) trials.

This does not mean that such fisheries will not become commercially viable in future. Prices of fish (apart from skipjack tuna, unfortunately for the tropical Pacific) are continually rising, and fish that were previously considered unpalatable become popular. It should however be noted that SPC recommends that any SPC island member approach potential trawl fisheries with a great deal of caution. Bottom-trawling is rapidly becoming considered to be one of the less "eco-friendly" fishing methods for two main reasons: it changes the seabed, and it usually results in substantial bycatch – often greater than the amount of usable fish caught. Attitudes within the international community are expected to harden still further, with calls for moratoria on bottom trawling on the high seas, or in certain areas already being made (or accomplished), and areas which have not already been trawled might prefer to remain in an undisturbed state.

Other oceanic fisheries are also theoretically possible, including mid-water trawling and squid-jigging but, again, the trials that have been made elsewhere in the Pacific (particularly by Japanese trial fishing expeditions from the 1950s to 1980s) have not been promising.

OTHER FISHERIES ISSUES TO BE CONSIDERED

Membership of regional fisheries organisations

The Convention for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean[6] has been under negotiation for nearly a decade, and came into force in 2004. The first meeting of the Commission[7] established to administer this Convention took place in December 2004 in Pohnpei, Federated States of Micronesia, where the Secretariat of the Commission will be hosted. The first meeting proper of the Scientific Committee of the new commission will take place in August, in Noumea at SPC headquarters. We understand that the UK has not taken part in any of the negotiations leading up to the establishment of the Commission, despite the involvement of the rest of the SPC membership and the likelihood that at least part of the Pitcairn EEZ might have been included within the WCP Convention area. The European Union has not been a part of the negotiations either, except latterly as an observer, but is now set to become a full member of the Commission. However, it is understood that UK membership of the European Union does not include its territories, and the EU is presumably not legally competent to speak for Pitcairn fisheries interests.

The fact that the leader of the interim secretariat – the Director-elect of the new Commission – is a British national has meant that UK interests have perhaps not been entirely overlooked, but the fact that only part of the Pitcairn EEZ is within the WCP commission area, yet is wholly within the Eastern Pacific aegis of the Inter-American Tropical Tuna Commission (IATTC) is potentially awkward, and could possibly have been avoided. On the other hand, the fact that there is no licenced tuna fishing within the Pitcairn EEZ might have suggested that the considerable investment required to attend all of these negotiations would not have been cost-effective. It would certainly have cost far more than the fishery income of the Pitcairn EEZ. And potential membership of two commissions spanning the whole range of the tropical Pacific Ocean – a significant proportion of the Earth's surface – might be seen as politically advantageous in certain circumstances.

Membership of these regional intergovernmental fisheries commissions is also one means by which the prospect of unreported poaching might be reduced. The UK can obtain information about fishing on the high seas adjoining the Pitcairn EEZ, take part in DWF vessel registration and information-sharing systems, and membership might even be considered an expectation under international law.

The WCP Tuna Commission will set the overall total allowable catch of tuna from the Western Central Pacific, and part of the Pitcairn EEZ is within the area of oversight of the Commission. The UK may wish to take part in any negotiation that leads towards the setting of such catch limits. The Commission will also be the only current mechanism by which areas of high seas in the Western and Central Pacific might be

[6] www.ocean-affairs.com is the interim website of the Commission and contains the text of the Convention
[7] Usually known as the "WCP Tuna Commission"

governed, and will provide a mechanism by which high-seas marine protected areas etc might eventually be declared. The high seas are of course also the main haven for IUU (Illegal, Unregulated and Unreported) fishing, and WCP is the last major global area with high seas that are not yet subject to any form of fishery management regime. Again, involvement would provide the UK with a say in any decisions that may be made about high seas areas adjacent to the Pitcairn EEZ, or indeed anywhere within the WCP.

A similar set of issues applies to the IATTC area of the Eastern Tropical Pacific. IATTC is a longstanding organisation, and thus far has apparently not taken much account of its western boundary except to include the area in the theoretical range of its Eastern Tropical Pacific tuna stock assessments.

At the moment, it does not appear that Pitcairn has lost much by non-involvement in these processes, but could find itself at a disadvantage in future as the regulation of ocean areas tightens up, and decisions are made in its absence with implications for the conservation or management of the Pitcairn EEZ.

Fisheries management legislation

There do not appear to be any management plans in place to govern any Pitcairn fisheries, apart from the Henderson Island World Heritage Site Management Plan 2004-9, which does mention fisheries in passing. Fisheries are managed according to tradition, in the case of Pitcairn-based fishing (a situation which is appropriate for a population of 50 people or less and in the absence of any likelihood of overfishing by locals), and according to government-to-government, or government-to-company agreements in the case of the licencing of foreign fishing vessels. The latter is guided not by a management plan, but by a policy of seeking the means towards more economic self-sufficiency whilst referring to regional standards for fishery conservation and management.

In the past, the Pitcairn administration has usually sought the assistance of SPC, and through SPC that of the Forum Fisheries Agency, before finalising negotiations either with distant water tuna fishing nations or with companies wishing to trial nearshore fisheries. This occurred in the late 1980s when an access agreement was negotiated with the Japanese Government, and also around 1994/5 when there were negotiations with another East Asian fleet. In this way, regional standards for fishing vessel reporting and behaviour have been incorporated into specific agreements or contracts with external fishers without the necessity for detailed legislation to be drawn up.

However, if Pitcairn does become associated with one, or both, of the regional tuna fishery management bodies for which it is eligible, there would be a need to eventually ratify these conventions by enacting legislation covering the Pitcairn EEZ that would enable the provisions of these conventions, and to draw up management plans for any of the fisheries covered by these conventions (currently only tuna, but “bycatch” species like turtle and shark may also need to be taken into explicit account in future).

Poaching

Although this is not easily controllable in such a remote area as the Pitcairn EEZ, illegal fishing is an issue faced by all Pacific Islands. What makes control feasible is a combination of deterrent penalties enforced during very occasional prosecutions, and the sharing of information through regional fisheries organisations. There is not a huge amount of “pirate” or IUU fishing within the EEZs of the tropical region, and most of the infringements come from foreign vessels that are licenced in one or more Pacific Island countries straying outside their defined areas. The airforces of New Zealand, Australia and France have been of great benefit to South Pacific nations by overflying their waters and reporting possible infringements to authorities on the ground. There is agreement between FFA members about pursuing illegally fishing vessels across boundaries, and there are agreements covering observers aboard tuna vessels, as well as a regional register of legal fishing vessels, requirements for reporting on fishing vessels crossing boundaries, electronic vessel monitoring and position systems, and regional standards for marking vessels in a way that is visible from the air. Although Pitcairn is obviously unable to mount its own patrol vessel, there is perhaps some possibility of cooperation from New Zealand for air-overflights and French Polynesia for vessel-based policing.

We have seen no reports of illegal fishing vessels ever being apprehended or prosecuted within the Pitcairn EEZ, and it is possible that Pitcairn waters are currently seen as being more "open" than others.

The ecological consequences of unpermitted or uncontrolled landings by passing yachts and commercial vessels, particularly to the Henderson World Heritage Site, and the use of the uninhabited Pitcairn islands for more nefarious purposes, are possibly related issues that might also be addressed in any attempt to improve fisheries enforcement.

RECOMMENDATIONS

In conclusion, the only immediate and realistic prospects for deriving income from the marine resources of the Pitcairn EEZ appear to lie with the licencing of distant-water tuna fishing vessels, particularly albacore longliners, although the area has not apparently much interested DWFN fleets in recent years. Pitcairn lies on the margins of the major tuna fishing grounds, on the limits of the range of both the Eastern Tropical Pacific and the Western and Central Tropical Pacific fleets, and to be profitable boats would have to range over a wide area apart from the Pitcairn EEZ.

In terms of coastal fishing, Pitcairn is remote from markets, and has a very small area of fishable shelf. Even Pacific Island countries which are relatively well-supplied with overseas transport connections do not export much reef-fish, apart from extremely high-value fish such as the live reef fish food trade – something which requires a high level both of investment and application, and which has not yet proven profitable even in Polynesian countries closer to the main Asian markets, such as the Cook Islands. As a general rule, if a commercial fishery doesn't work in the rest of eastern Polynesia, then it is not likely to work in Pitcairn. There are no vast, untapped resources of valuable fish or shellfish in the Pitcairn EEZ, despite the wishful thinking of many New Zealand-based fishers.

Briefly, the main recommendations are as follows:

1. **Explore the possibility** of sending a UK fisheries delegate to represent Pitcairn interests at the next meeting of the WCP Tuna Commission (probably in December 2005 in Pohnpei) or the next meeting of the WCP Scientific Committee in Noumea in August. This would be for the purposes of:
    - Getting a feel for the kinds of decisions that will be made about regional fishery stocks ranging through the Pitcairn EEZ and judging whether or not regular participation in regional fishery management processes is likely to be useful; and
    - making contact with distant-water tuna fishing interests and potential Pitcairn EEZ "licencees" in an atmosphere conducive to informally exploring possibilities;

    To informally explore the terms under which Pitcairn and the UK might be represented at the meeting, it is suggested that the Director-elect of the WCP Tuna Commission, Michael Lodge, is contacted[8]

2. **Invite a small team from SPC** to visit Pitcairn (hopefully with a quick side-trip to Oeno) sometime during 2005 to look at some potential fishery prospects at first-hand, to carry out some basic underwater visual assessment of potential reef-fishery species, and to document Pitcairners' customary and modern fishing and fishery management practices[9]. Although Pitcairn is not included within the geographical scope of the EU-funded SPC reef fisheries assessment project[10], it should be possible for SPC to source some additional assistance to carry out some scaled-down work using similar mechanisms and reporting protocols. Note also that the SPC Director-General had expected to make a visit to Pitcairn in 2004 – the only SPC member never yet visited by an SPC Chief Executive – but this had to be postponed in view of

[8] Current email address Michael.LODGE@oecd.org in London.
[9] Note that regional decisions need to take into account established resource-management practices within EEZs, and documentation of these practices is thus not an entirely intellectual exercise.
[10] "PROCFish" - http://www.spc.int/donors/procfish/proc_coastal.html

the legal processes going on it Pitcairn during the latter part of the year. It may be possible to accomplish this trip before the Lourdes Pangelinan's term as DG expires in December 2005.

3. There are two alternative mechanisms for the development of coastal fisheries. Although it is not recommended that any requests for expressions of interest or invites to tender be advertised for any Pitcairn coastal fisheries at the present time, given the equivocal results of previous vessel-based exploratory fishing, if the SPC visit does suggest potential sustainable coastal "boutique" fisheries or mariculture prospects, then the subsequent competitive selection of private-sector interests in either New Zealand or French Polynesia would probably be the most appropriate way of testing these. Given the limited fishery resources of Pitcairn such ventures are likely to be financially risky, and the romance of fishing around one of the remotest settlements on earth might need to be supplemented by a guarantee of exclusive access for a certain period, if "rental" income is desired from Pitcairn coastal fisheries without the direct involvement of Pitcairners. The alternative is to try and encourage shore-based small-scale fisheries, with the full involvement of Pitcairners, but given the small human resource base of the island and the extremely limited access to market this is not likely to be very feasible. The current situation where there are occasional fish sales to passing vessels, and fishing for local tables, is probably already the most appropriate coastal fishery for the scale of the place;

4. If new fisheries or fisheries agreements start to emerge, it is recommended that **regional organisation assistance is sought in the establishment of management plans** or policies for those fisheries. Through SPC, the Forum Fisheries Agency would probably be willing, as in the past, to help in drawing up tuna fishery agreements that incorporate regionally-agreed minimum terms and conditions for access, and SPC can assist in planning the management of coastal fisheries, and in such mundane matters as deciding what data should be included in catch-return forms.

5. Although it may seem beside the point, possibly one of the most obvious prospects for generating income from the Pitcairn EEZ would be to **prosecute an illegal fishing vessel**. Although this might require considerable investment and some luck, there is possibly quite a lot of surveillance that might be carried out in cooperation with other countries who are interested in helping secure their own borders and in finding out what is happening nearby. Many South Pacific countries rely on New Zealand and France for aerial surveillance, and Pitcairn might need to "contract out" its marine surveillance entirely. Unfortunately Pitcairn cannot be a member of the Forum Fisheries Agency, which has helped so many other islands to organise themselves against illegal fishing, but association with the WCP Tuna Commission or IATTC might be useful in this regard.

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Annex 1

Agreement

between the Pitcairn Government
and the Marine Resources Division of the Secretariat of the Pacific Community
towards the fulfillment of a request to produce a report on

The Potential for Development of Fisheries in the Pitcairn EEZ

Background

The Pitcairn Government generates revenue primarily from philately sales. However, stamp sales are now declining, and the islanders need to investigate alternative sources of revenue to ensure a sustainable future. Pitcairn exercises sovereign rights over a substantial maritime area, in the form of its Exclusive Economic Zone, and fisheries provide a realistic opportunity for the generation of revenue. However, in view of Pitcairn's diminishing financial resources and extremely limited human resource base, any start-up or recurrent investment would be limited and particular consideration must be given to the significant financial risks involved in the establishment of certain forms of fisheries. Before any action can be taken, further information must be sought about the viability of developing this option as a sustainable source of income for Pitcairn.

The Secretariat of the Pacific Community (SPC) is a Pacific Islands regional intergovernmental development and natural resource management advisory agency, of which Pitcairn is a full an equal member alongside 26 other countries and territories, including the United Kingdom[11]. Apart from undertaking special projects in specific subject areas, SPC also maintains a general capacity to respond to official requests from its member governments for assistance, particularly advisory and development information assistance, provided these are within its areas of competency and of an appropriate scale. SPC has particular competence in the area of Pacific Islands fisheries development and fishery resource survey, and maintains the globally-recognised collection of data on the fisheries of the region.

This Letter of Agreement outlines the work that will be undertaken by SPC on behalf of the Pitcairn Government, and the commitments of both the parties, to achieve the following aim:

Aim of the study: through a preliminary desk study, evaluate the potential for the development of fisheries and aquaculture within the Pitcairn EEZ as a viable source of sustainable income for the Pitcairn Government.

Planned outcome: a written report fulfilling the aim of the study to the Pitcairn Government, to assist in deciding the value of further investment in the development of its fisheries.

Commitments of the Secretariat of the Pacific Community

Scope of work: The SPC Marine Resources Division, in consultation with other information providers as appropriate and to its best ability within the limitations of the available information, will produce a report that describes the potential for development of a range of coastal and oceanic fisheries, and aquaculture, including:

- A summary of oceanography and coastal ecology within the Pitcairn EEZ;
- An analysis and summary of all available and relevant information about fishing and aquaculture activities and surveys that have previously occurred within and adjacent to the Pitcairn EEZ;
- A description of potential fishery and aquaculture developments, and the likely requirements for commercial establishment and sustainability;

[11] Until December 31st 2004, when the UK withdrawal from SPC membership takes effect. The UK has however indicated that Pitcairn will remain an SPC member.

- Consideration of the potential liabilities and benefits of any administrative, regulatory, monitoring and surveillance infrastructure likely to be required to ensure that fishing and aquaculture activities remain ecologically and economically sustainable;
- Analysis of the potential need and scope for involvement in regional fisheries commissions and other international processes concerning the management of highly migratory stocks and large marine ecosystems.

Resources: The desk-study described in the preceding paragraph will be carried out by the SPC Marine Resources Division at no additional cost to the Pitcairn Government[12]. The production of the report and the drafting of the main conclusions will be carried out by the Director of the Marine Resources Division, and several Sections or Programmes of the Division will contribute chapters or background material to the report, particularly the Oceanic Fisheries Programme, the Aquaculture Section, the Fisheries Development Section, the Fisheries Information Section and the Reef Fisheries Observatory. The report will draw upon the Regional Fisheries Databases maintained by SPC, and informal advice will be requested, as appropriate, from the Pacific Islands Forum Fisheries Agency, the Interim Secretariat of the Convention for the Conservation and Management of Highly Migratory Fish Stocks of the Western and Central Pacific Ocean, and the Inter-American Tropical Tuna Commission.

Timeframe: The report will be completed and conveyed to the Pitcairn Government by December 20th 2004.

Commitments of the Pitcairn Government

Release of information: The Pitcairn Government will permit SPC to access or utilize any information that is held by either party to this agreement, or held by a third party as a result of work accomplished on behalf of the Pitcairn Government, in the furtherance of this study.

Availability of local counterparts, transportation and other in-kind support: Not applicable.

Limitation of liability: The Pitcairn Government will not hold SPC liable for any outcome of putting into practice any of the advice provided in the report, provided that advice is given in good faith and does not result from avoidable error, or carelessness in the analysis of information, by SPC.

Confidentiality of outputs: The final report will be the property of SPC, in the sense of the copyright remaining in the ownership of the collectivity of SPC member countries and territories, but the report and its contents will remain confidential between SPC and the Pitcairn Government for a period of two years unless an earlier date for limited or full release is agreed by the Pitcairn Government.

Agreed by

Governor
For the Pitcairn Government

Director-General
For the Secretariat of the Pacific Community

14th October 2004

[12] Note: A financial "assessed contribution to the SPC work programme" is provided annually to SPC on behalf of Pitcairn.

Annex 2

(Abbreviated version of the original report)

PITCAIRN ISLAND FISHERIES RESOURCE SURVEY - 1994 OBSERVER TRIP REPORT

Peter Sharples
August 1994

1.0 BACKGROUND

From 1987, when a viable sub-tropical convergence zone (STCZ) albacore fishery was established, the central South Pacific region has had a substantial increase in commercial fishing vessel traffic. Fishers are attracted south from North Pacific fisheries and east from New Zealand. They carry their catch from southern STCZ waters to Levuka, Pago Pago and Papeete frequently traversing the waters of Pitcairn, Ducie, Oeno and Henderson Islands. Rumours of illegal fishing abound and in 1988 there was a recorded tentative foray by one vessel polite enough to seek permission. News of that visit has since been told in numerous watering holes by the crew. A Pitcairn Islander, at home at the time but since living abroad, has persistently tried to raise a commercial fishing venture into his home waters. Hardly surprising, then, the interest shown by several small fishing companies in exploring harvest potential of these waters.

Beset with approaches from entrepreneurs - some independent, others aligned to Pitcairn Island interests - and resolved to provide careful sound advice to residents before they invest in a venture excessively, the Office of the Governor of Pitcairn, in late 1992, approached the South Pacific Commission (SPC) and the Forum Fisheries Agency (FFA) for assistance in developing a management strategy to utilise the fishery resources within their 200 mile EEZ. License would be issued to suitable prospector on condition they were prepared to provide comprehensive information of the resources encountered in that zone.

SPC evaluated the capacity of the interested companies to fish those waters and made recommendations accordingly. The British government contributed funds to employ an SPC scientific observer, Peter Sharples, to join an initial commercial exploratory survey. FFA helped set up a licensing arrangement which reflects current management trends in the region and addresses Pitcairners particular concerns. Data will be evaluated by SPC to provide some indication of potential stocks.

In September, 1993 license was offered to the Stewart Island, New Zealand company, Southern Seafoods. Their application for license proposed an initial six weeks (of fishing) trip using their two vessels, *David Baker* and *McLachlan* to search for lobsters, deep-water snappers and gropers. The expedition departed Stewart Island bound for Pitcairn on 2nd of April, 1994.

This report is a general description of the trip by the observer - the operation of vessels and initial impressions of potential fisheries in the zone. Gross catch figures are included so the Pitcairn administration can verify those provided by the fishing vessel in meeting its licensing obligations. A technical paper addressing catch and effort data in greater detail, and management recommendations that may ensue, will follow.

2.0 DESCRIPTION OF PITCAIRN ISLAND FISHERIES ZONE

Four small islands situated between latitudes 23° and 26° South and longitudes 124° and 131° West comprise the Pitcairn Island group. The exclusive economic zone (EEZ) and thus fisheries management zone covers 800,000 square kilometres of ocean. Tahiti, 2000 km to the northwest, is its nearest neighbour. Easter Island lies a similar distance to the east. The waters of Pitcairn Island are fished by its inhabitants. Oeno, Henderson, and Ducie are uninhabited and just occasionally visited. They are rated in that order of importance for fishing use by the Pitcairners. Pitcairn is a high volcanic island, Henderson a raised limestone atoll and the other two are small low coral atolls rising to four metres above sea level.

2.1 Pitcairn Island

Location: 25°04'S, 130°06'W. A high island with poorly developed coral reefs. It has neither a barrier reef nor a fringing reef. Sea floor drops to below 3000 metres within two miles of the shore in all directions. The sea floor slopes more gently to the west of the island where locals have fishable depths out to 500 metres and more off-shore. Elsewhere slopes are steeper with fishable depths not extending beyond 200-300 metres from shore. Pitcairners fish these whenever weather is fair, the catch going to home freezers for later use at table or in trade with passing vessels.

2.2 Henderson Island

Location: 24°22'S, 128°20'W; 200 km ENE of Pitcairn Island. It has been exposed to the minimum of human disturbance and is reputed to be the most pristine elevated limestone island in the world. It's 3,700 hectares (maximum dimensions of 9.6 km x 5.1 km) are mostly on an extremely flat plateau 33 metres above sea level. The surrounding reef ranges from 50 to 100 metres wide but extends up to 200m in the east, northeast and northwest of the island where long narrow beaches average 50 metres in width. In the south vertical cliffs prevent access from sea. On all sides the sea-floor slopes sharply away from the reef.

2.3 Ducie Atoll

Location: 24°40'S, 124°47'W; 472 km east of Pitcairn Island and 1,336 km WNW of Easter Island. It comprises 70 hectares of land, mostly in a strip no more than 200 metres across, which shelters the 320 hectares of lagoon from the north and east. A narrow 50 metre reef trims this island. There are three tiny islets in the south on a high but not quite dry reef, half a kilometre wide, that completes enclosure of the lagoon. A limited exchange of sea water results in a high salinity within the lagoon. Ducie's isolation means it is seldom visited and remains undisturbed. Mainly coral rubble it supports very limited flora, but abounds in bird life. On all sides the sea floor slopes steeply with many distinct underwater cliffs. The slope is a little less steep in the south and south west. A wider platform (to about 250 metres) on which to fish both reef finfish and the deeper slipper lobsters was found here.

2.4 Oeno Atoll

Location: 23°56'S, 130°45'W; 120 km NNW of Pitcairn. Lagoon and land form a rough square with 4 km sides running parallel to lines of latitude and longitude. The wooded islet of Oeno forms to

the south on the western reef and runs north-east into the lagoon ending with a sandspit that at times (as when the fishing vessels *David Baker* and *McLachlan* first arrived) extends unbroken to Sandy Islet near the east end of the north reef. During our stay strong westerlies lasting several days created seas and currents that carved a gap of 50 metres through the 15 metre wide spit. The resulting two islands are as shown on the charts that were used during this survey. The lagoon, although a good size, was not accessible to either vessel and the surf at the passages presents problems for small boat access. The sea-floor was uniformly steep around all the reef.

2.5 Pelagic

Pitcairn's four small islands that rise steeply from the sea floor, occupy little more than 60 sq.km. of the subtropical ocean in its 800,000 sq.km. EEZ. At first glance there would seem to be a potential for pelagic fisheries in the zone. Landing records held at SPC show there has been activity in Pitcairn waters by Japanese, Korean and Taiwanese longliners since at least as far back as 1962. These have caught yellowfin, bigeye and albacore tunas. However the absence of land or shallow waters in the Pitcairn zone would imply less favourable conditions for the occurrence of surface schools of skipjack and yellowfin to support pole and line or purse-seine fisheries of significance.

2.6 Other

To the south east of Pitcairn lies a sea-mount that Pitcairners refer to as 40-Mile Reef. Located at 25°23'S, 129°15'W it rises to 70 metres below sea-level. This was the richest fishing ground found throughout the zone but was limited in size to little more than two square kilometres of fishable grounds.

Other high spots exist to the north-east of Pitcairn and to the north-west, west, south and east of Ducie but none of these rise to be less than 200 metres below sea-level and do not attract fishing activity.

3.0 THE VESSELS (See table 1 for specifications)

3.1 F/V David Baker

An ex Japanese style pole-and-line vessel the *David Baker* is aging. It is short in trimmings and comfort (the observer had to clear space amongst the spare parts to construct his own bunk) but nevertheless has been well cared for in recent years. Sound structurally and mechanically, it has had superb freezing facilities added. Bridge navigation electronics were basic but adequate with good back-up, although only one radar (less of a weakness with *McLachlan*'s radar at hand). A sophisticated depth sounder was never fully utilised. The desalinator fitted for the expedition freed space for seven extra tonnes of fuel. Although not in current deep-sea survey *David Baker* was slipped immediately prior to sailing and passed a thorough structural inspection by a ship's surveyor.

The *David Baker* bestowed longevity on the venture and provided the means to cover the distance to Pitcairn. It left Bluff in New Zealand with holds full of food and fishing gear, decks laden, enough spare parts to build another ship (or so it seemed) and fuel tanks full. Twenty tonnes more fuel

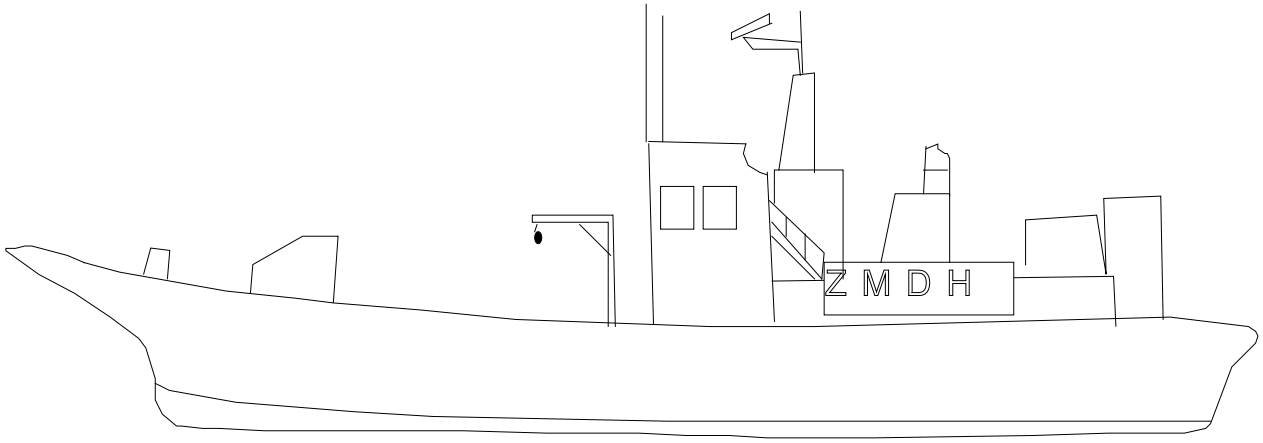

Figure 13**: F/V David Baker.**

was stored on deck (another nine on deck of *McLachlan*) so that 85 tonnes total fuel was packed for the trip. Both vessels had plimsolls awash on departure.

The *David Baker* is a sound sea boat but proved clumsy at the manoeuvres required to lift and set pots or droplines, the main methods utilised. Techniques were developed to enable it to do most of the line work while *McLachlan* was left to concentrate on the lobster pots.

3.2 F/V McLachlan

The *McLachlan* is an impressive vessel with an impressive reputation. It is an aluminium craft built in New Zealand to British North Sea and Atlantic coast life-boat specifications. Beamy and robust it is an extremely manoeuvrable vessel proven in unescorted visits to the Auckland Islands of the Southern Ocean. It has a full although not elaborate bridge electronic array. Although too small for an extended trip on its own this vessel is a capable off-shore worker and superb for working close to reefs in tricky waters. It was an excellent choice for the expedition.

The *McLachlan* was used almost exclusively to work the lobster pots but for several days towards the end of the survey was set up to employ a fishing method modified from the Hawaiian "Kali" system (using rigid droppers). It deployed and recovered this gear effectively.

TABLE 1. SPECIFICATIONS OF THE VESSELS USED IN THE PITCAIRN FISHERIES RESOURCE SURVEY - 1994

	F/V DAVID BAKER	F/V McLACHLAN
Built:	1975	1983
Radio call sign:	ZMDH	ZMA 3826
Port of registration:	Nelson, New Zealand	Bluff, New Zealand
Master:	Joe Cave	Merv Moodie
LOA:	28.2 meters	17.0 meters
Breadth:	5.2 meters	5.2 meters
Gross Registered Tonnage:	108 tonnes	
Skipper and Crew (minus observer)	6	3
Navigation equipment:	2 x SatNavs, 2 x GPS 1 x radar	GPS with plotter 1 x radar
Depth sounders:	Furuno FCV-140 (multi-frequency)	Elac 2500 (150 kHz) & Kaijo Denki (200 Khz)
Radios:	2 x SSB, 1 x VHF	1 x SSB, 1 x VHF
Other electronics:	SST gauge	
Freezer capacity:	30 tonnes	8 tonnes
Minimum freezer temperature:	-45 °C	-55 °C

Auxiliary craft: one 3.5 metre aluminium dinghy with 15 hp outboard, one 5.0 metre aluminium dinghy with 25 hp outboard and one 3.0 metre inflatable dinghy shared between the two vessels. (N.B. This is in addition to regular life rafts on each boat.)

4.0 OVERVIEW OF ACTIVITIES (Trip Itinerary attached as appendix 1)

In transit

It took three weeks and three days to reach Pitcairn from Bluff. Weather was reasonable with a constant swell between two and four metres. That is until just a few days short of Pitcairn when a significant storm was encountered. Then winds sometimes blew to over fifty knots with seas enormous and erratic. The barometer at Pitcairn had dropped to the lowest that one particular radio operator could remember seeing in the thirty-five years that she had been monitoring it. The tow line to the McLachlan broke for the second time.

The first was during the first night out from Bluff. That had been a little disconcerting so early - could this be the pattern for the trip ? But it was a good exercise, the tow repaired without too much trauma, using superior rope. The tow then held until the storm. This time the McLachlan gathered in her end of the tether and sailed on under its own steam - much happier that way in these worsening conditions. Overall it was a relatively event-less passage with the only other interruptions being the casting of plankton trawls in search of phyllosomas (crayfish larvae) for New Zealand's Ministry of Agriculture and Fisheries, Fisheries Research Centre. A couple of sea mounts were also fished along the way.

Pitcairn

Once at Pitcairn four days were spent redistributing fuel and getting the vessels properly prepared for fishing. The observer spent the time interviewing locals with fish identification media in hand to discover local species names and habitats. He was also able to develop an impression of fishing habits, effort and catch-rates. A further, unexpected, task for the observer was to mediate in a political turmoil and public relations exercise selling this operation as a good one that was not a threat to the Islanders' own aspirations. They, it would seem, saw the expedition very much as a one off trip, from which they would gain information to set up their own operation, and were not at all warm to the idea of any future fishing ventures by Southern Seafoods. At this time Southern Seafoods were eager to have option to return. Joe Cave (owner of Southern Seafoods and skipper of the David Baker) related well in his brief visit ashore and when the vessels moved on there appeared an amicable relationship.

Henderson

From Pitcairn it was to Henderson Island - one days steam - a trip to the corner store after nearly a month to Pitcairn. That was the 3rd of May. This stay was 4 days - to get a feel for fishing potential. Pitcairners had been mostly negative about fishing around Ducie, the planned starting location, so Joe wanted a taste of fishing at Henderson to help in deciding to abandon Ducie early if fishing there turned out disastrous. McLachlan worked the 15 crayfish pots it had unpacked from its freezer while the *David Baker* worked set lines. Just a few slipper lobster (*Scyllarides* sp.) and a few spiny lobsters (*Panulirus penicillatus* and *Panulirus pascuensis*) were caught. These were duly sampled by the crew. The slippers were preferred eating on board but little more was known about them. Further research indicated that live slippers could fetch strong prices. The spiny lobster was a more familiar looking animal to these fishermen with *P. penicillatus* being a colourful species common to several South Pacific Islands (painted crayfish and pronghorn spiny lobster being two common names).

Half of Henderson has cliff faces around it with many caves. Anchorages are close and dangerous. A small reef surrounds it. Within the reef smaller spiny lobsters are plentiful in shallow water. This was frustrating as these were out of bounds for this operation which was not permitted to hand pick, although the observer took a team ashore one night to do a quick census of the reef. Catch-rates outside the reef remained low and the expedition continued to Ducie. The 15 pots were left to soak at Henderson.

Ducie

To Ducie was fifteen hours calm steam. The stay there was 17 days. The atoll is mostly coral rubble covered in scrub and birds, not overly attractive but interesting. The hundreds of thousands of birds are easily approached and walking through the scrub requires great care lest one stands on them. Mostly they are various petrels but Christmas shearwaters, red-tailed tropic birds, boobies, noddies, terns and great frigate birds are also in abundance. The shore is littered with washed up flotsam.

Using the 25 pots unpacked from *David Baker*'s freezer the *McLachlan* continued fishing, catching mainly slipper lobsters. The most successful pot set scored 20 weighing around a kilogram each. The early hauls yielded 80_100 fish a day for the 25 pots but after just five days there were 40 a day. This held for a week then rapidly declined - 30 one day, 20 the next and after 16 days fishing only 17.

An eight foot moray eel from one pot created some excitement when it nearly removed a hand trying to retrieve a slipper lobster believed lodged in its gullet. Damage was restricted to minor lacerations, a pleasing aspect of the voyage being that this was the only casualty of any sort.

Henderson and Oeno

Next Oeno Island via Henderson Island - about 14 hours back to Henderson to retrieve the 15 pots left there - carried on through to Oeno after two hours lifting pots, looking for two that were missing, finding one. Our total was now 36 pots as 4 had been lost due to various causes. Arrived at Oeno just over a day out from Henderson. It was 9:00 am, the sun was shining brightly and Oeno looked a stunner. Classic tropical atoll. It is wooded and surrounded with coral sands. The Pitcairners use it as a holiday resort and have planted coconuts and breadfruit. It is further surrounded by a shallow turquoise lagoon and a wide reef that just breaks the surface at low tide. This visit also lasted 17 days.

Lobster fishing was not so good. Though Ducie and Oeno are similar - low lying atolls surrounded by reef - fishing was quite different. After scratching away at six to eight lobster a day the emphasis moved to targeting coral trout (*Variola louti*, Pitcairner's fafaya, Australia's coronation trout) - Joe had identified an eager market for this species. But catch rates were never great despite a variety of methods employed to capture them and the crew soon became disillusioned. In the final days diving and other recreation activities prevailed. A lot of interest was aroused by the discovery of three separate ship-wrecks. Three days were spent in the somewhat leisurely but commercially motivated pursuit of gathering beche de mer (*Holothuria nobilis*, black teatfish).

Again the lagoon offered no anchorage - no channel deep enough for either vessel to negotiate. The swell usually sufficed to prevent vessels tying alongside each other so they each anchored outside the reef and the crew of the *McLachlan* commuted the 400 meters or so by dinghy to join the *David Baker* for meals each evening. There was a constant watch, crew being roused to heave

anchor for a run to another side of the island in adverse wind changes. (Henderson, considerably larger, afforded even less attractive anchorage as there was such lengthy flight to lea.)

Weather at Oeno was mostly fine but with plenty of wind and swell. Water temperature hovered around 25°C (as high as 26°C on first arriving) and of air between 20° and 28°C, a degree or two warmer than the other islands. The final day the weather was too rough to fish so we departed a day earlier than planned.

Pitcairn and 40-Mile Reef

On 14th June the F/V's *David Baker* and *McLachlan* arrived back at Pitcairn Island to fulfil Joe's offer to transport an ensemble of Pitcairners to Henderson to gather miro (species of timber) for carving. The waters of Henderson would be fished a few days then Pitcairners and their wood returned home. But the rough weather convinced earlier enthusiasts against going and the trip was abandoned. Joe made an alternative offer to take the handful of keener fishers to 40-Mile Reef, the catch to go to the community. This small sea-mount is approximately 40 miles south-east of Pitcairn and was reputed to have abundant fish, though two previous visits in Pitcairn's long-boat had produced abundant fish on one occasion and none on the second. This trip produced easily the best fishing of the entire survey and the two days fishing with droplines filled every freezer on the island.

Two meetings took place during this visit to Pitcairn. The first was a public meeting prior to the fishing trip. It was used for the observer and Joe Cave to relate activities and give impressions of the fishery potential. Joe suggested ways he thought that Pitcairners could most profitably benefit from future commercial fishing. The second was after visiting 40-Mile Reef when Joe and observer were invited to a meeting with four directors of Pitcairn Island Fishing Company who discussed joint-venture arrangements with Southern Seafoods.

Oeno

A formal departure from Pitcairn was made on 20 June but Oeno was revisited to uplift lobster pots which had been left there. There was also one more (unsuccessful) attempt at deep-water dropline fishing. Eight days were needed to recover equipment much of which had to be dived for. Oeno was the steepest of all islands visited and the tides around it had perplexed and frustrated the crews throughout. Strong currents held buoys down for days and some pots were moved down the steep slopes. Several pots were lost altogether.

Specimen collection

Throughout the trip numerous species were collected and stored either frozen or in formalin. These were the product of regular fishing effort, from deliberate excursions with the ichthyocide, rotenone, or from pieces of coral lifted aboard the vessel. The samples will go to the Natural History Unit of New Zealand's National Museum for positive identification of species caught and to add to their collection. A list of samples, with notes, as provided to the museum, is attached as appendix 2.

Exit from Pitcairn's EEZ was at 1200 hours on 30th of June. The vessels were bound via Mangareva to Rarotonga to purchase fuel sufficient to return home.

5.0 FISHING (commercial catch is summarised in appendix 3)

From the outset attraction to Pitcairn for foreign fishers was hope of bountiful lobster stocks and it was to catch lobsters that these vessels came best prepared, both with experience and equipment. But Pitcairn's administration had indicated it would encourage a company prepared to investigate potential of a variety of fisheries. Southern Seafoods had proposed (in application for license) to "spend six weeks at the Pitcairn group islands lobster potting and drop-lining for deep-water snappers and groupers". Later, when contributing to preparation of a fishing plan (survey), they outlined "fishing techniques employed will be wide ranging, and will include droplines, bottom jigging, bottom 50 metre long set-nets, ring nets, side and top entry lobster pots and fish traps. The surface fishing potential would be explored by trolling". These were all attempted at some time during the expedition, though not always persevered with. No method produced exciting results and so the vessel continued to modify its gear and try new gear. By voyage end more than 20 different techniques had been tried, some of those with various modifications. Hence the observer was continually having to modify methods for collecting fishing effort data. The list of gear used is attached as appendix 4.

The different fisheries that Southern Seafoods came prepared to look at included: shrimps and prawns; slipper and spiny lobsters; various types of reef fish; deep-water snappers and groupers; pelagics; and beche de mer.

To locate fishable banks and seamounts Southern Seafoods had invested in satellite detected gravity variation charts. It was hoped that, with these, bathometry of unplotted waters could be assessed more accurately than was possible through previous methods.

5.1 Shrimps

To look at shrimps was not in any initial plans for a visit to Pitcairn but was a belated inclusion in response to information sent by the SPC observer to Southern Seafoods that described commercial survey work on deep-sea shrimp trapping for *Heterocarpus laevigatus* in the Hawaiian archipelago. The success of this survey at similar, though northern, Pacific latitudes spurred the interest in Pitcairn shrimps.

Large pyramidal traps (figure 3) based on the design of those used in the Hawaii survey were built on board the *David Baker* in transit to Pitcairn. Initially these pots had small openings designed for shrimp (90mm x 90mm) but a trial set before Pitcairn waters were reached caught a crab large enough to block the opening and prevent further access. A similar crab clung to the side. Possible commercial potential for these crabs provoked modification of the design to incorporate a larger opening (210mm x 210mm).

Two more trap designs were used, neither productive. The "long-box" (figure 4) was a design researched from articles on Caribbean shrimp fishing and also built on board. It caught some shrimp and one small Aesops lobster but insufficient to encourage further construction. A trap, that did catch a few shrimp was originally built to catch slipper lobsters. The flat-box design (figure 5), believed used in Hawaiian lobster fishing, was not suitable for catching the larger Aesop lobster predominant in Pitcairn's waters even after modification to increase the entry aperture. Two pots were set almost daily throughout the trip but usually caught just a few shrimp.

The biggest catch was from a pyramid trap. But 140 small narval shrimp (*Plesionika narval*) did not make commercial fishing and the norm at any one set was more like 6_20. Narvals were by far the most prominent of the three species caught, the other two yet to be positively identified. Most were caught in waters around Ducie but were found throughout the trip. Although never caught in a quantity sufficient to encourage building more, those traps that were built did serve to trap rubbish fish species used for bait. No further crabs were caught.

Early poor results from other deep-water operations discouraged effort in those waters so that the deeper water shrimps (*Heterocarpus* sp.) that first aroused interest due to the Hawaiian connection were never properly targeted.

5.2 Lobsters

Where were all the lobsters ? Without doubt the main incentive for fishing Pitcairn waters was the great crayfish El Dorado. However, during this survey insufficient lobsters were caught to cover trip expenses far less make Captain and crew a gold mine. The one island (Ducie) that initially yielded commercial quantities (of slipper lobster) rapidly declined in productivity after only a few days fishing.

Four species of lobster (or crayfish) were caught during the survey: Pronghorn spiny lobster, *Panulirus penicillatus*; Easter Island spiny lobster, *Panulirus pascuensis*; Aesop slipper lobster, *Scyllarides haanii* (or Blunt slipper lobster, *Scyllarides squammosus*); and Red spotted mitten lobster, *Parribacus holthuisi*. Samples of all of these have been sent to New Zealand's National Museum for positive identification.

5.21 **Slipper lobsters**

The majority of slippers were caught around Ducie. Most were caught in McLachlan's conventional "4 x 4" craypots (figure 6), but the odd small lobster was caught in the Hawaiian style flat slipper lobster pot (figure 5).

The average weight of slippers was 1.2 kg with the heaviest caught, a female, weighing 2.6 kg. Size was consistent, the bulk of the catch being between 1.0 and 1.2 kg (28_30 cm combined length of tail and carapace).

The catch of *Scyllarides haanii* was very poor at Henderson (15 from 4 sets of 15 pots). This helped make the 100 a day (25 pots) that was initially caught at Ducie look respectable. But it was not great fishing for virgin ground and the catches dropped steadily after a week. This is more significant when it is considered that both the grounds and fishery were new to these fishermen and catches were dropping while they were climbing a steep learning curve. With catch-rate down to 17 on the last day the Captain, who had persuaded himself that Oeno was likely better ground, steamed for that atoll. In 25 days at Oeno only 34 slippers were added to the 935 on board.

Total weight of slippers brought on board was calculated as 1115 kg. All slippers were tailed to yield 400 kg of product. The conversion used to calculate product weight was 35.8% (2.79 reciprocal) calculated from weighing of 38 lobsters (43.6 kg) and their tails (15.6 kg), caught at Ducie on the 15th of May. All slippers caught on Oeno were kept live until the end of fishing when they

were tailed. Separate weighing of males (14.8 kg) and females (27.9 kg) indicated 37.1% (5.5 kg tails) and 36.9% (10.3 kg tails) respectively (2.69 and 2.71 reciprocal).

At a glance it would seem that the fishing pressure on Ducie led to decline in catches. But it is perhaps not so simple. Ducie was departed on a full moon, a time of the month that is known to coincide with adverse catch rates in other lobster fisheries. Shallower water catches of the spiny rock lobster (*Jasus edwardsii*) that these fishermen catch in home waters can decrease markedly. Although these Ducie slippers were caught relatively deep (80_120 metres) waters are very clear and it is quite possible the moon affects the animals similarly.

Pitcairners suggest uncertainly that lobster catches are better in October, November, December, but details were sketchy. For example, no clear answer emerged when they were asked if spiny or slipper lobsters differed in that respect. It may be that effort increases during those months, the months of May, June, July being of less favourable seas. There are several questions this one-off short assessment cannot address, but as it stands this survey has not inspired the fishermen to return in a hurry for lobsters.

5.22 **Spiny lobsters**

Spiny lobsters were only caught at Henderson Island and in too few numbers to keep the fishermen there. The pronghorn spiny lobsters, common throughout the Western South Pacific, were present in reasonable numbers on the shallow reef adjacent to shore but were unavailable to these fishermen as their license prevented them from hand-picking.

On 04 May two crew swam to shore and returned reporting up to a dozen seen sheltering under the ledges of each of two dead coral outcrops on the reef ("a dozen under every rock") weighing around 500_600 gms each. They were not there on the evening of 06 May when the observer took three crew ashore to count those found along a 250 metre stretch of reef (one was under each). There are only occasional such coral structures on the portion of reef we viewed (NW beach) which is noticeably barren. Two of the searchers were equipped with mask and snorkel and all had torches yet only 14 crayfish were counted in the approximately 12,500 square metres searched. This was a disappointing result after Pitcairners descriptions of walking along the reef and filling their bags. Perhaps on this night conditions favoured the animal being elsewhere. Those counted were scattered evenly between beach and breakers with some in ankle deep water.

One short low tangle net and three hoops (figure 7) were experimented with in the shallow waters near the reef, catching nothing. But 22 spiny lobsters, mostly males, were caught in four days fishing with 15 pots. When females were found they were always paired in a pot with a (usually larger) male. On two occasions the female was *P. pascuensis* and the male *P. penicillatus*. Unfortunately these were the only occasions that the species were separately classified.

All spinys were caught in lobster pots (see figure 6) despite Pitcairners assurance that spiny lobsters were not potable. Pitcairners use a variety of pots all very much smaller than those aboard the McLachlan.

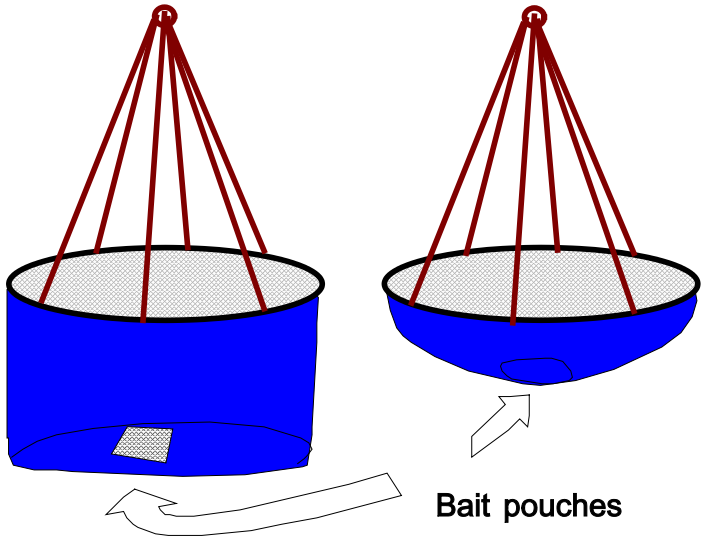

Figure 7**: Hoop nets. (1200 mm diameter).**

Style at left is 1200 mm deep.

Style at right is 360 mm or 600 mm deep.

5.3 Reef Fish

The shallower (50_120 metres) reef fish were not initially a target fishery for this operation but soon became so when fishing at the greater depths as originally intended produced poor results. Several species were caught using a variety of methods to deploy hooks. Most significant of these were coral trout (*Variola louti*) and marbled grouper (*Epinephelus polyphekion*). Pitcairners call these "fafaya" and "potato skin cod" (or just "cod") respectively. Less important to this operation were blacktip or banded grouper (*Epinephelus fasciatus*), hexagon grouper (*Epinephelus hexagonatus*), and peacock trout or blue spotted grouper (*Cephalopholis argus*). Banded grouper are "red snapper" to Pitcairners while the other two also get lumped under the generic term "cod". A list of all species for which Pitcairn names were ascertained is listed in appendix 5.

Reef fish were all caught on hook and line using a variety of methods to deploy hooks. A mixture of Mustad #14 and #16 circle hooks (figure 8) were used in all methods. Initially 25 hooks on 0.5 metre snoods were deployed 1.2 metres apart on a wire backbone vertical dropline. When it was realised that only the lower half dozen of these fish were catching preferred species the droplines were converted to short bottom longlines. Bottom longlines snagged cruelly to the coral so, after much loss of hooks and patience, a system was developed whereby a longline was floated a few metres above the bottom and from it nylon droppers bearing 10 short snoods with hooks was suspended. But, with the limited hauling gear and line handling experience of the *David Baker*, the method proved unwieldy - it is an inherently awkward arrangement at best - so a system using rigid droppers was adopted (figure 9). This was based on the "Kali" system used in Hawaiian reef fishing. In Hawaii droppers are constructed of 20mm diameter polyethylene pipe and such pipe had been purchased before departing Stewart Island. But the pipe was never loaded and so the method not attempted until late in the voyage when crew made do with steel rod left over from construction of shrimp and lobster pots.

This gear was deployed by the *McLachlan* on the last few days of effective fishing at Oeno. It

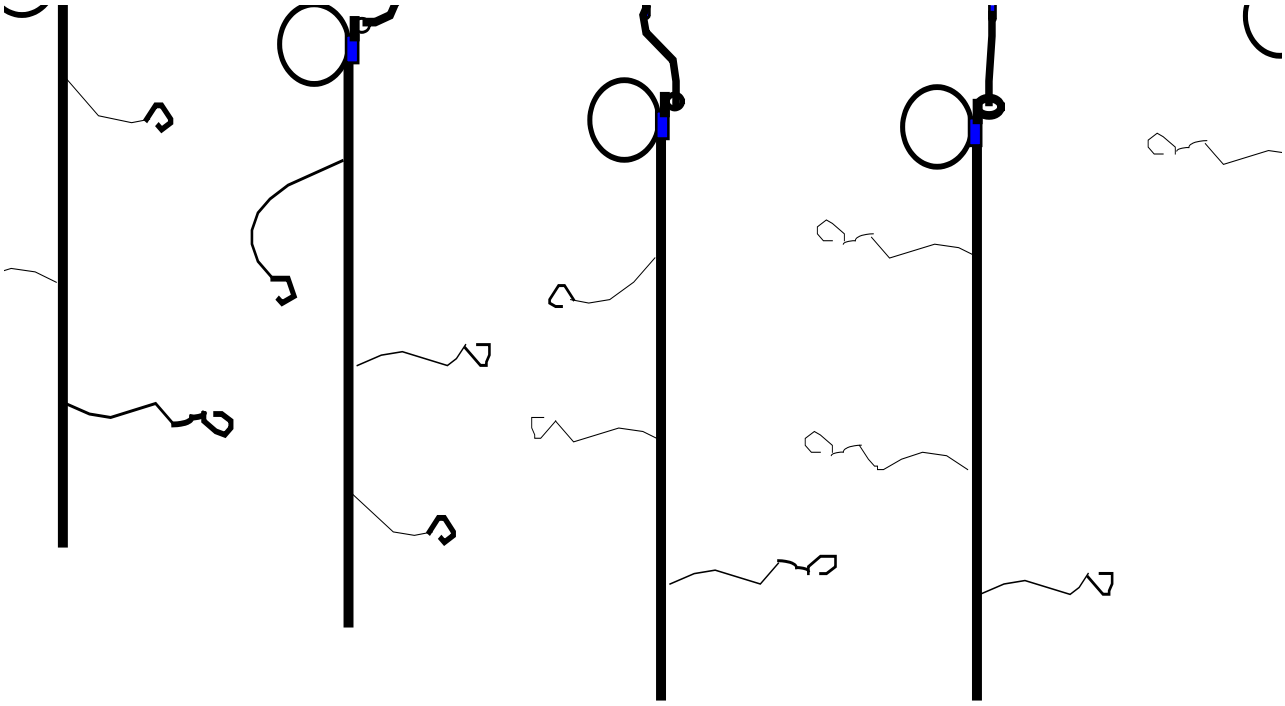

Figure 9:**Adapted from Hawaiian "Kali" system, steel droppers (15mm dia. x 3.5m long), each with 3 hooks on 40cm nylon snoods, are capped with aluminium buoys (30 cm dia.).**

was the superior method used for deploying hooks during this survey. A shame it was not utilised and improved upon earlier.

For a day that *McLachlan* worked droppers *David Baker* tried hand-jigging and out-caught *McLachlan*. However hand-jigging was labour intensive. The scope for increasing effort using droppers, without increasing crew numbers, may be several fold, but though hand-jigging skills can be improved there is little room for increased effort. Nevertheless the success with hand-jigging supports speculation that an efficient way to utilise the reef finfish resource is to fish from small vessels, such as the skiffs of the Pitcairners, into a larger freezer mother vessel or on-

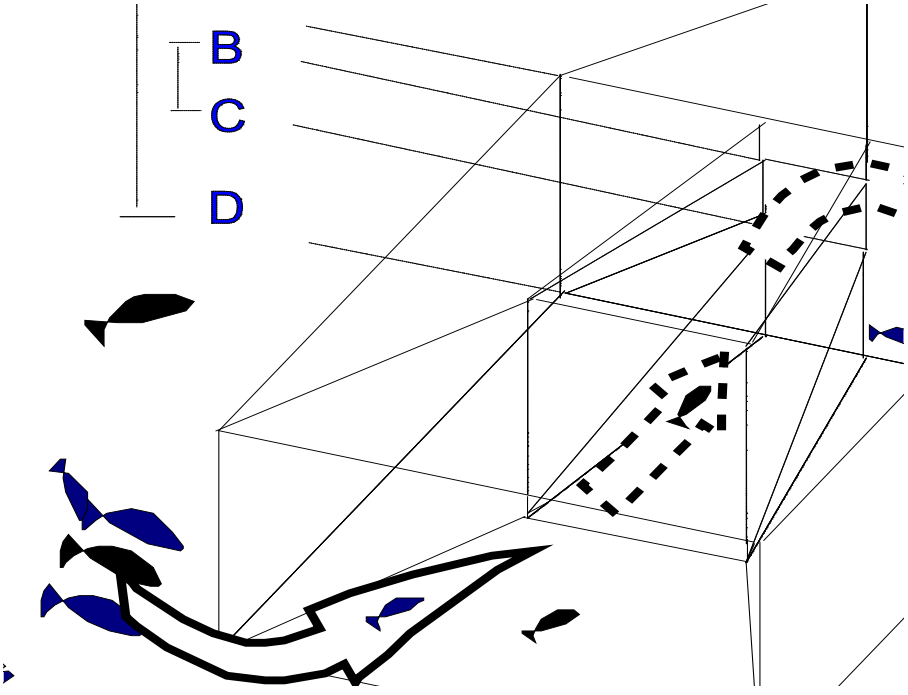

Figure 10: **Chevron-like fish traps. The observer labelled the three traps "K1 _ K3". K1 & K2 traps had entries (A _ D) that spanned the full height. K3 trap had a small high square (B _ C) entry.**

shore freezer (provided adequate ice making and carrying apparatus are available for the skiff operators). Skiffs are considerably more efficient hand-jigging - more manoeuvrable on the narrow fishing zones afforded by the steep sea-floor.

In an attempt to increase the take of *Variola louti*, and to see what other species might be caught, three Chevron-like fish traps (figure 10) were made. They were set at depths of 20 to 80 metres around Oeno Island. Various baiting and setting strategies were used to deploy them but they were never successful at catching anything other than blue stripe snapper (*Lutjanus kasmira*) and a variety of rubbish fish. Though good to eat *L. kasmira* is too small a fish to have commercial significance.

The fishing on 40-Mile Reef using droplines, bottom longlines and hand-jigging produced excellent catches of *E. tuamotuensis* and good catches of *V. louti*, *E. fasciatus* and *Seriola lalandi* (yellowtail kingfish). Fishing was in depths of 70_185 metres. Almost as much fish was caught on these two days as on the rest of the trip put together. Unfortunately no lobster pots were brought. Despite the good catches it must be noted that all fishing took place in an area no larger than a kilometre square, an area easily fished out by a commercial enterprise. No other similar sea-mounts were found in Pitcairn's EEZ.

5.4 Deep-water bottom fish

As mentioned, it was originally intended that the majority of bottom fishing with hook and line would be at greater depths targeting deep-water groupers and snappers (*Pristipomoides*, *Etelis* and *Epinephelus* species). On the first day of fishing in Pitcairn these depths were targeted but brought miserable results, despite the *David Baker* being guided to good areas by Pitcairners. The lines used were droplines with 25 hooks. Eleven sets were made averaging 2.3 hours soak time each and at depths ranging between 200 and 830 metres. The days catch was three fish: a snake mackerel (*Promethichthys prometheus*); three striped grouper (*Epinephelus tuamotuensis*) from 220 metres; and a small (< 1.0 kg) deep-water red snapper (*Etelis carbunculus*) from 310 metres. Other deep-water sets were: two on 8th May on a sea-mount west of Ducie (540 metres) - nothing caught; seven on 12th to 13th May at Ducie (330_400 metres) for fifteen small *E. carbunculus*, eight unidentified warehou type species, a *P. prometheus* and loss of one entire backbone and hooks; two on 17th May at a sea-mount to the south of Ducie (630 metres) for nothing caught; four on 21st June at Oeno Island (310_370 metres) for one small *E. carbunculus*. All deep-water red snapper caught were small (around one kg.) so this catch-rate was no incentive to the fishermen to pursue deep-water species.

Another commercially significant deep-water fish encountered was a *Pristipomoides* species. These were caught at Oeno Island by the *McLachlan*. Two were caught in a wide-mouth pyramid shaped shrimp pot which had been set at just 120 metres. Four others were caught on rigid droppers at around 100 metres. The observer identified these as *P. flavipinnis* (yellow eyed opakapaka) but specimens have been sent to the New Zealand National Museum for formal identification as this species is normally found in deeper water.

Deep-water species have behaviour patterns that can dishearten even experienced fishermen so the lack of experience for such fishery that accompanied this trip likely had significant effect on catches. Nevertheless it is probably safe to reject rumour of major stocks being present.

5.5 Pelagic fishing

Neither vessel was set up for bottom or pelagic long-lining and these methods were not employed successfully. The *David Baker* attempted one foray with a very reduced pelagic long-line setup comprising 34 hooks baited with needlefish (*Platybelone argalus* ?) caught the previous night. No baits were touched and *David Baker* returned to the slopes that day to continue reef fishing.

Trolling was pretty much restricted to travelling between islands or fishing stations. Although the *David Baker* had been fitted with outriggers for trolling it was only a rare occasion that a full array of lines were towed. For essentially recreational purposes two crew regularly trolled using rod and reel. Their catch was dogtooth tuna (*Gymnosarda unicolor*), yellowfin tuna (*Thunnus alalunga*) and wahoo (*Acanthocybium solandri*). Some exceptionally large dogtooth tuna were caught at Henderson and Oeno, a classic indication of low reef exploitation. Yellowfin tuna were taken at Ducie and Oeno but only occasionally, though schools of yellowfin were regularly seen working close to the reef around Oeno Island. Most yellowfin caught were small (5_15 kg).

Although a small effort was made to test the pelagics it was clear that tuna was not considered worth targeting. This was probably because the skipper felt that refrigeration was inadequate to carry tuna to a value market. There was little fishing experience of this sort aboard. Hence there is very little data on pelagics to emerge from this survey.

5.6 Beche de Mer

Harvestable numbers of Beche de mer were sought throughout the trip. Marketable species were observed at Henderson and Ducie but it was only at Oeno that quantities were thought sufficient to be worth gathering. It was late in the trip before three forays were made into Oeno lagoon to collect the high value species, black teatfish (*Holothuria nobilis*). On one foray the observer was able to carry out a small density assessment (appendix 6).

Gathering beche de mer was a pleasant task. The two dinghies were taken through reef passages, the larger one anchored as close to the action as deeper water (greater than one metre) would allow. Four crew with masks, snorkels and fins collected the animals in bags and emptied them into the small dinghy which was ferried back and forth to the large dinghy by a fifth crew. The days catch was returned to *David Baker* for gutting, packing and freezing.

Just over a tonne was collected which yielded 640 kg of gutted product to return to New Zealand for further processing and market research. The onset of weather that inhibited safe entry to the lagoon thwarted any further gathering.

5.7 Summary of effort

Areas Fished	Days fished by *David Baker*	Days fished by *McLachlan*
Pitcairn	1	0
Henderson	4	5
Ducie	9	17
Oeno	12	12
40-Mile Reef	2	0

Other sea-mounts	3	0

The above table covers effective fishing days only. It does not include travel between grounds, days constructing equipment, or time spent ashore collecting lagoon and rock-pool specimens. All of *David Baker*'s fishing effort was dedicated towards fishing with hook and line whereas ninety per cent of *McLachlan*'s effort went into setting of lobster pots, the remaining ten per cent setting shrimp traps, fish traps, gill nets and "Kali" style rigid droppers. *McLachlan* spent five to seven more days recovering lobster pots drowned in the whims of currents and depths of off-shore Oeno Island. Ten lobster pots, three fish traps, a shrimp trap and innumerable hooks were lost during the course of the survey.

6.0 COLLECTION OF SCIENTIFIC DATA

Catch and effort data for use in indicating initial stock levels, evaluating present commercial viability of stocks and in setting base indicators to help assess impacts of future fishing effort, were the priority in data collection. Second priority was in collection of length and weight data used to enhance catch and effort data through better understanding of the fish populations worked. It was hoped that aging material (most likely otoliths) could also be collected from species which were more seriously fished. This latter task was never carried out as catches of most common target species were sufficiently meagre the observer was reluctant to damage what little there was.

6.1 Forms

Data collection forms had been designed before the trip. These were suitably modified through the trip to reflect alterations in methods of fishing and target species. They consisted of:

- fishing log sheets maintained aboard each vessel on which date, time, position, depth, bottom type, gear used, catch and any additional notes were recorded for every set and haul of fishing gear;

- catch summary sheets maintained for each species and updated daily with the days catch, fate of catch (bait, crew's mess, discard or to the hold for market), and cumulative trip totals (different styles of sheets were used for fin fish, lobsters and beche de mer);

- forms to record length and weight data for fin fish from each fishing event that measurements were taken; and

- forms to record total length, carapace length, sex and weight for each species of lobster.

Later in the trip forms were also created to record information from which to study the preferred location of hooks on the different types of line gear used. This latter study was at bequest of fishers that they could fine tune their gear, but may have a wider interest.

To alleviate the space demands some data categories have on forms and to lessen the time required to fill the forms, short codes were devised to describe gear types and to identify type of catch. The codes used to describe gear are attached as appendix 4. These comprise a single letter denoting a style of fishing, followed by a number. The number either identified an discrete gear item (as with fish traps which varied in design and were set individually in situations with specific set data) or it noted the number of items used at one time (as in number of troll lines). Because new methods were brought

into use throughout the trip all the letters from "A" to "T" in the alphabet were used. The codes used to identify fish species and other items recorded as catch comprised of three letters. Although the Food and Agricultural Organisation (FAO) list of such codes prompted their use here it is important to note that those used on this trip were all created on board by the observer, who did not have an available copy of FAO codes. A list of on board codes is attached as appendix 7.

Blank copies of all forms used to record data during this survey are attached as appendix 8).

6.2 Catch and effort

Every creature that came aboard either vessel was counted and recorded on fishing logs. The logs also record set and haul times for calculating soak time and, through identifying the gear used, enable a researcher to determine number of hooks, length of net or other relevant effort information. The observer spent the bulk of his time aboard the *David Baker* which was forever changing gear type and target species. Setting a routine for collection of useful effort data was therefore quite the challenge. The *McLachlan* concentrated on working lobster pots for which the *McLachlan*'s skipper diligently kept the observer designed fishing log for each and every set, thus providing accurate catch and effort data.

6.3 Lengths and weights

Fin fish lengths were measured on both vessels using wooden measuring boards marked with one centimetre graduations. Lengths were rounded down to the nearest whole centimetre. Fish were measured with mouth closed and body laid straight. Fork lengths were taken for *Variola louti*, *Caranx lugubris*, *Acanthocybium solandri*, *Gymnosarda unicolor*, *Lutjanus bohar*, *Seriola lalandi*, *Pristipomoides flavipinnis* (?) and *Kyphosus bigibbus*. Total lengths were taken for *Epinephelus fasciatus*, *E. tuomotuensis*, and *E. polyphekion (microdon)*.

The observer used days that *David Baker* was under maintenance, building new gear or otherwise not actively fishing, to work aboard *McLachlan* collecting length, weight and sex data from lobsters. Carapace and total lengths were measured to the nearest 0.5 cm with plastic rule.

Weights were measured using regular clock-faced spring balance scales calibrated to 0.1 kg.

6.4 Specimen collection

Collected specimens were stored in formalin if less than about 10 centimetres long, or else frozen. Each was double labelled with a "sample identification number" and the "fishing event number" that associated it to a logged record of the fishing event from which it was obtained. Hence date, time, position, and depth data for a specimen can be obtained through this logged record. In cases where specimens were collected from non-fishing events the position, date, and depth were recorded on labels. These were also recorded in a catalogue of specimens (appendix 2) along with general descriptions of areas samples were from.

6.5 Photos and video

Photographs and video footage were recorded of most aspects of the trip. Most collected specimens were photographed fresh before being committed to formalin or the freezer. There are also photographs and video footage endeavouring to capture fishing methods, vessels and gear used, general shipboard life, the nature of the islands being worked and Pitcairn fishing craft. These are obtainable through the observer. Several still and video cameras were also carried by crew.

7.0 INFORMATION ON PREVIOUS FISHING ACTIVITY

7.1 Some evidence

03rd May -McLachlan found a lobster pot on the west side of Henderson Island. The rope broke just before the pot emerged from the water. The fishermen on board judged that the rope gave the appearance of having been set for a couple of months or more (?) There were no identification marks on buoy or rope.

21st June -McLachlan picked up some interesting gear at Oeno Island. About 200 metres of high quality nylon rope, 30-40 mm diameter, well spliced, connected to two high quality "A4" buoys which had collapsed under the pressure at depth. Tied to it was the remains of a heavy duty plastic sheathed 15 mm wire rope bridle. Unfortunately the bridle had broken from its charge. Subsequent investigation indicated that this gear was very similar to that (unique) equipment used to work the large lobster pots that John Chadderton used from his vessel the *Mata Whao Roa*. The gear recovered by the *McLachlan* appeared to be very clean, devoid of the growth expected on ropes that have been in the water for more than a few weeks. It is quite possible that the gear was at depths less conducive to growth but the evidence in hand (it was entangled with *McLachlan* gear set at 200 metres) suggests that it was at depths in which some growth might be expected after weeks rather than months.

One more buoy and line was found at Ducie Island but records were not taken. The line was hauled but parted from whatever it was attached to at the bottom. The gear was aged - perhaps a year or more (?)

There is none hard but enough circumstantial evidence, to make it scientifically relevant for assessing stocks, that a commercial vessel fished for lobsters in Pitcairn waters (although not around Pitcairn Island itself) in winter 1993.

Pitcairn Islanders report regularly monitoring radio traffic on lower frequencies, suggesting more than one vessel could be within Pitcairn waters. These usually operate in an Asian language and could quite plausibly be longline fishing vessels working pelagic fisheries.

7.2 Of a 1988 foray in Pitcairn waters by a commercial vessel

The 1988 visit by *Mata Whao Roa* was probably catalyst to the considerable amount of recent interest in fishing Pitcairn waters. But anecdotal accounts gleaned from a variety of sources indicate that this visit was not especially productive. The vessel fished briefly around Pitcairn and probably, though unsuccessfully, also around Oeno. With unconventional two metre high by metre diameter steel pots, reputedly very successful in a low exploited cooler water spiny lobster fishery, it had no

success at Pitcairn. However it fared better with smaller plastic "200 fathoms plus" pots set around Pitcairn Island in 20 to 25 pot strings. These caught slipper lobsters at an estimated average of eight per pot. Only three of these sets were made. About 20 steel pots set had yielded one spiny lobster. There was little concerted effort in other fisheries on this visit.

8.0 NOTES ON PITCAIRNERS' FISHING BEHAVIOUR

There are eight or nine hard core fishers on the island with another three or four who also fish fairly regularly. On any fine day that is not booked out for some public duty or communal task or activity at least six and often up to nine skiffs are out fishing most with one fisher but a couple with two aboard.

If fishing is poor (catch rate of four or less an hour) then fishers return after a short while (an hour or two at the most). Good fishing could keep them motivated until three or four in the afternoon after an eightish start.

Women and men fish regularly from the rocks - mainly for nanwi for the evening meal.

If a large vessel is expected (in particular a cruise vessel) then fishing effort increases and the hard core could be out fishing from dawn to dusk. In such circumstances target species are likely to be fafaya (*Variola louti*) and big eye (*Etelis carbunculus*). The emphasis is on red fish which the Asian crews of these vessels (mostly Filipino and Indonesian) go for. For the larger cruise ships it is important that Pitcairners can supply large quantities of a similar species so ship's chefs can prepare en masse. Though preferred there are times when red fish may not be sufficiently plentiful for such vessels.

Trading in fish has thus become very important to the Islanders who actively seek opportunity to do so. Radios are monitored constantly for indication of ships in the vicinity and if heard a vessel is called and encouraged to stop to trade goods - fish, fruit, vegetables and, if a cruise vessel, carvings and other souvenir crafts. Goods are usually sold to cruise ships with fish generally fetching US $5.00 per kilo regardless of species. Lobsters, when available, fetch closer to US $10.00. With the freighters that stop fish is usually bartered and the value received differs considerably from vessel to vessel. American vessels are popular because they will often swap kilo for kilo, fish for high quality meat. Asian vessels tend to swap dry goods. Pitcairners usually go aboard and bargain individually but may at times (particularly with cruise ships) have to lump their fish together then share out the proceeds (in their own special fashion) later.

If fishing for the table, nanwi (*Kyphosus bigibbus*) appears to be the favoured target species. Red snapper (*Epinephelus fasciatus*, black-tip grouper) is good eating and the next most plentiful but it is a small fish requiring more work in preparation and consequently loses a little in popularity both for the table and as a trade fish. Nanwi is caught as readily from the rocks on shore as it is from a boat and seems abundant enough to order one fresh caught on demand _ almost. Boat fishing appears mostly dedicated towards securing fish for trading.

Any excuse to launch the long-boats (passing vessels being the best) is used to assemble a fishing crowd which will include some who do not fish much otherwise. The magistrate is encouraged to launch early on such occasions in order to get an hour or so extra fishing.

Lobster catches have decreased considerably over the years and the small pots used spend a lot of time ashore now. As one keener fishermen put it "the catch rates are not sufficient to risk the equipment". Rumour has it (though it is not openly admitted) that even within the past year or two local catches have been sufficient for a few lobsters to be marketed through New Zealand contacts (New Zealand has long been a destination for lobsters sent as gifts). But at present this has stopped due to difficulty catching. Pots remained ashore during each of our visits to Pitcairn but then weather was also a discouraging factor. Nevertheless, lobsters are scarce enough for locals to be secretive amongst themselves as to where their latest catch has come from, supposedly a more modern phenomena. Contrary to outsiders' impressions and in conflict with tenets of the local church, lobsters are eaten by several Pitcairners.

Only slippers (*Scyllarides* sp.) are taken in pots. Spiny lobsters (mostly *Panulirus penicillatus*) are generally taken by hand.

The Fishing Contingent

Hard core				Regulars
Ron	.....	....	Charles	Jay
Randy	.....	....	Steve	Brian
Len	.....	....	Dave	Olive
Claris				Merelda
Paul				
Terry				

Some, as indicated, will regularly, but not always, fish in pairs (usually relatives) either both in the same boat or more commonly the two boats together.

Pitcairners View of Fish Stocks

(riders from SPC observer in brackets)

Charles:Fish stocks are good now, especially compared to what they were in days after the war (I wonder what involvement Pitcairn had). Back then you could fish all day to catch ten fish but now you can go out on a good day and after two to three hours bring home sixty or seventy (I saw this happen). Over that war period (population around 130) there were up to thirty-eight boats going out, many with two to three people in them to get their ten fish for the day. Now (population around 50) nine boats fish with one, occasionally two, in them. They return with fifty to sixty fish (I doubt this is the norm). Fish are larger now and there is definitely more of them.

Steve:Fish stocks have been declining for years. He fished out a patch of fafaya eighteen years ago and the fish just poured aboard. But he hammered that spot then until there were no more and it has never recovered. Most stocks around Pitcairn have diminished in recent years and the fish have got generally smaller. that is with the exception of nanwi which were once caught on only certain banks but can now be caught almost anywhere close to shore. Certainly they were once not available at the jetty and other convenient spots as they are now. They appear to have been steadily increasing for about fifteen years.

Jay:Concurs with Steve when prompted by him but I feel he would not stress the depletion of stocks so strongly otherwise.

All:Agree that nanwi stocks are increasing year by year.

Back to Charles: When confronted with Steve's opinion admits to a certain diminishing of fish availability in the past year or two but maintains that the Islanders have it easy these days. (But then that is Charles' swan song). "In my day boats were made of wood and the men of iron. Now they have metal boats and wooden men."

9.0 PITCAIRN ISLAND OBSERVERS

There were none. On arrival it was clear that there was little enthusiasm amongst Pitcairners for spending any more than a few days to a week on board, especially once the quality of accommodation was noted. Although the *David Baker* and *McLachlan* were prepared to carry Pitcairn observers as under terms of their license, they also were happy to not have extra people aboard for any length of time. A fishing day trip on first visit to Pitcairn and a scheme to carry Pitcairners to Henderson for a week of wood collection, while those who wanted stayed aboard to observe fishing operations, were compromise both parties were pleased to have in place of a regular observer arrangement. The day trip was little more than a shake out of gear with little to be learned from that performance. However, the Henderson trip was later converted to a two day trip to 40-Mile Reef (when weather discouraged turnout for the longer trip) during which the four who came actively participated in the vessel's operations and in the SPC observer's activities.

10.0 SOUTHERN SEAFOODS AND PITCAIRN

Joe, once aware that no El Dorado would eventuate, turned his trip into rather a crusade, determined to find means for Pitcairn to best utilise their resource. At a public meeting held near the end of the survey he discussed at length the use of shore based freezing facilities that small boats could fish into. He had successfully raised his business in New Zealand by fishing from a dinghy into a remote based freezer in Fiordland and would willingly assist Pitcairners get started. He also suggested that a smaller commercial vessel, little larger than the long-boats they presently have, but equipped most importantly with adequate freezer gear and capable of fishing the other islands, would be more feasible than a larger commercial venture such as his own. He could fish profitably for two to three years, he believed, then the fishery would collapse. A smaller vessel, used more as a mother-ship to the Pitcairners skiffs could be manned by the Pitcairners and may even be adequate to transport fish to Tahiti for transhipment. Spiny lobster stocks on Henderson could be sacrificed to help initial financing of the venture and such a plan was sound enough to likely attract outside financial aid. Joe suggested the British government - the Islanders laughed.

Though his thoughts and suggestions were sound, a factor not accounted for was whether the Pitcairn Islanders wanted to work their own fishery. They mostly shied from his suggestions and, in a meeting with the "Pitcairn Island Fishing Company" called by PIFC to discuss possible joint venture arrangements, implored that he come fish their waters that they could at least get a small cut of the profits before outside poachers depleted their stocks for no return to Pitcairn. Pitcairners appear

unexcited about fishing commercially themselves. As they point out they are not over-endowed with man-power. Joe persisted that the only sensible way to go was alone but relented, under pressure, to agree they should call him if they insisted on going with an outsider. It is doubtful he could be tempted back unless combining such a venture with another. He may do.

11.0 SUMMARY AND CONCLUSIONS

The trip was not a huge success. The fishermen involved made no money and discovered no resource that would attract them back. These fishermen were on a steep learning curve. They had limited experience fishing coral reefs, were not used to dealing with the precipitous slopes of sub-tropical islands and atolls, and had little knowledge of behaviour of the deep-water bottom species they hoped to find. Because no resource appeared particularly abundant fishing methods changed regularly in order to maximise coverage and in the hope of finding a productive formula. This made it difficult to standardise catch and effort data for accurate stock analysis.

But Pitcairn chose and has fared well with Southern Seafoods, who put up the entire venture capital for the survey. Despite finding little financial incentive to stay, the company stuck with the task of trying to identify resources while rigidly adhering to the constraints on species and fishing areas that were imposed in their license. It worked methods familiar to it then was prepared to be innovative, building a variety of fishing gear as it went. Its fishermen worked hard at trying to fathom what was available in those waters.

The species of lobster they found are not those usually associated with sustainable cray-fishing and the quantities not remarkable enough to expect more than a one off concerted harvest of any significance. Good catches of coral trout (*Variola louti*) at Oeno were indicative of low exploitation but the small grounds would not sustain more than one or two full on commercial assaults. The rich fishing of 40-Mile Reef was indeed exciting but again the limited grounds suggest rapid depletion by a commercial enterprise. Deep-water bottom species did not appear to be present in attractive commercial quantities and shrimp did not feature as a fishery. Harvestable quantities of beche de mer were found at Oeno. These are easily gathered, without sophisticated fishing equipment, by any who master handling and processing techniques.

Pelagics were not pursued in the survey but the presence of yellowfin tuna was noted and indication that a tuna longline fishery could exist in these waters might be drawn from distant water fishery nation catch data held by SPC (more of this in the technical report). Note that high value tuna fisheries need ready access to air freight space or especially sophisticated freezing apparatus. Pitcairn is only likely to utilise such fishery through involving appropriate outside commercial interests, as it has previously.

General feeling amongst survey fishers and observer is that more effort would only have yielded minor improvement in lobster catches (just a tonne yielding 400 kg of tails were taken). The tonne of beche de mer gathered could easily have been increased if gathering beche de mer had higher priority. Two tonne of finfish caught could have been bettered with a little more crew experience.

Time spent at Henderson was short and early in the trip - early in the ascent of learning curve. There is room for further study of those waters. The survey overall was short when considering the breadth of ocean and variety of fisheries it hoped to cover. Seasonal variations affecting abundance and behaviour in fisheries, particularly with lobsters, can make significant difference to a fishing

excursion. The data set obtained is thus a mosaic of different small data set pieces. These factors limit the conclusions that can be drawn from results of the survey.

However, the major drawback to sustainable fishing in Pitcairn waters is certain. The fishable area for most species is limited. Each of the islands fall sharply away from the reef to great depths affording very narrow fishing zones around very small land masses. Southern Seafoods made use of gravity variation charts and a variety of other sources of information in an endeavour to find more fishable banks and seamounts the likes of 40-Mile Reef, but to no avail. Possibilities still exist of such grounds lying further to the east of Ducie - untried this trip - and it is possible that better understanding of deeper water species may have produced better results on some of the high spots looked at. But the signs were far from encouraging.

The essence of Joe's message to Pitcairners in public meeting was that he could not identify a commercial fishery sustainable at level of harvest an operation like his needs, that could be economically justifiable to him and also able to give Pitcairners worthwhile return. This is in keeping with the SPC observer's own impressions. Further analysis of the catch data collected in conjunction with other available information will help clarify these views. Joe has indicated that he will be happy to report his own views to the Pitcairn Council and Pitcairn Administration once he has tested markets for his catch.

Approximately 300 specimens of fish and crustaceans were collected from 133 stations and either frozen or preserved in formalin or alcohol. These have been returned to the Natural History Unit of New Zealand's National Museum where they will be formally identified, catalogued and added to their collection. Staff of the museum have agreed to report on their findings to the Pitcairn Islands Administration and to the South Pacific Commission, confirming or correcting species identifications made in this report.

12.0 ACKNOWLEDGEMENTS

As the SPC observer on this survey I thank the following for their assistance and advice during my preparation for the trip: Alastair Eade and his crew, Stewart Island cray-fishers, for their hospitality aboard F/V *Thetis* and insights to their fishery; Paul Taylor, Talbot Murray and John Booth of the New Zealand Ministry of Agriculture and Fisheries; Ray Clark and colleagues of the United States National Marine Fisheries Service, Honolulu; and Pam Crommerty of the Department of Conservation, New Zealand. Encouragement and equipment for collecting specimens for archive was extended by Clive Roberts and Andrew Stewart of the National Museum of New Zealand who with Bertrand Richer de Forge of ORSTOM, New Caledonia, later assisted in species identification. For the hospitality and assistance extended on Pitcairn by all the community, thank you. Thanks especially to Steve, Olive and Deborah Christian for their home away from home and to Phillipa and Jed.

Joe Cave of Southern Seafoods financed and organised the trip and skippered the *David Baker*. Joe, with Merv Moodie (skipper of *Mclachlan*) and their crews, Aaron Connor, Graham Davis, Stewart Holt, Robin Jones, Alastair Midgley, Kevin Scurr, and Russell Sycamore kept the show running until fuel ran low. The British Government (agency ?) funded an independent observer through the South Pacific Commission's Inshore Fisheries Research Programme.

APPENDIX 1: **TRIP ITINERARY - Pitcairn Fisheries Resource Survey - 1994**

2 April - 5 August 1994

Observer met vessel 14 March (sailing date delayed)

02 April Sailed from Stewart Is. for Bluff aboard F/V *David Baker* - 1000 hrs.
04 AprilSailed from Bluff 1400, bound for Pitcairn.
07 AprilCrossed dateline so 2 x 7th April.
12 AprilStopped to fish seamount - half a day.
22 AprilStopped to fish seamount - half a day.

27 April - 30 April	At Pitcairn.
01 May	The day fishing around Pitcairn with Pitcairn Island contingent aboard. 2230 hours - departed Pitcairn bound for Henderson Island.
02 May - 07 May	Fishing around Henderson Island.
07 May	Travelling Henderson to Ducie Island.
08 May	Fished a seamount ENE of Ducie.
09 May - 15 May	Fishing around Ducie Island.
16 May	Fished a seamount S of Ducie.
17 May - 24 May	Fishing around Ducie Island.
25 May	Travelling Ducie to Henderson Island.
26 May	Travelling Henderson to Oeno Island.
27 May - 13 June	Fishing around Oeno Island.
13 June - 14 June	Travelling Oeno to Pitcairn Island.
14 June - 16 June	At Pitcairn.
17 June - 18 June	Fishing at 40 mile reef with Pitcairn Island contingent.
19 June	At Pitcairn.
20 June	Travelling Pitcairn to Oeno Island.
21 June - 29 June	Fishing and recovering gear around Oeno Island.
29 June - 01 July	Travelling Oeno Island to Mangareva in Tahiti.
01 July - 04 July	At Mangareva (looking at potential for transhipment).

Observer departed vessel 03 July.

04 July - 13 July	Travelling Mangareva to Rarotonga.
13 July - 20 July	Refuelling and R & R in Rarotonga.
20 July - 05 August	Travelling home to Bluff.

APPENDIX 3: CATCH OF POTENTIAL COMMERCIAL SPECIES DURING PITCAIRN FISHERIES RESOURCE SURVEY _ 1994

Species	Henderson	Ducie	Oeno	40-Mile Reef	Total	Retained on board	Landed catch estimate
	All weights for finfish in kilograms						
Coral trout	4	160	571	25	760	733	**560**
Striped grouper	15	156	53	697	921	194	**148**
Deepwater red snapper	8	22	2	-	32	26	**20**
Black Jack	191	700	607	73	1571	Bait or discard	**-**
Blacktip grouper	2	14	35	45	96	29	**22**
Wahoo	52	139	112	-	303	275	**210**
Dogtooth tuna	72	_	161	_	233	221	**170**
Yellowtail kingfish	-	380	-	101	481	303	**230**
Hexagon grouper	-	32	16	-	42	35	**26**
Yellowfin tuna	-	52	60	-	112	78	**60**
Marbled grouper	-	277	23	-	300	300	**230**
Nanwi	-	2	67	-	69	Bait	**-**
Total Finfish	**344**	**1864**	**1722**	**941**	**4945**	**2209**	**1687**
	Number of animals					**Retained catch**	**Landed weight**
Spiny lobster	22	-	-	-	22	15 animals	**?**
Slipper lobster	15	920	34	-	969	950 animals 1100 kg whole wgt.	**390 kg tails**
Beche de Mer	-	-	690	-	690	678 animals 1050 kg whole wgt.	**635 kg gutted**

To estimate landed finfish weight the green-weight (fresh whole fish weight) that was retained on board was multiplied by 0.85, a conversion to cleaned and gutted wei

APPENDIX 5: PITCAIRN FISH NAMES

Pitcairn names	**Common name**	**Scientific name**
Aut pig pig		*Novaculicthys laeniourus*
Aut cod, Snakeskin cod, Deep cod	Reticulate grouper (Striped grouper)	*Epinephelus tuamotuensis*
Aut cod, Snakeskin cod, Deep cod	Striped grouper	*Epinephelus morrhua*
Barracuda	Snake mackerel	*Promethichthys prometheus*
Be'ard	Goatfish	*Parupeneus* sp.
Be'ard (as for all goatfish)	Pink goatfish	*Parupeneus pleurospilos*
Be'ard (as for all goatfish)	Yellow band goatfish	*Parupeneus* sp. ?
Big eye	Ehu (Ruby snapper Deep-sea red snapper)	*Etelis carbunculus*
Bigeye (recognised different to Ehu)	Bigeye	*Priacanthus blochii*, *P*. sp.
Boni boni	Saber squirrelfish, (Long-jawed squirrelfish)	*Sargocentron spiniferum*, (*Adioryx spinifer* ?)
Cod	Blue-spotted grouper (Peacock grouper)	*Cephalopholis argus*
Cod	Hexagon grouper	*Epinephelus hexagonatus*
Cod	Marbled grouper (Smalltooth grouper)	*Epinephelus microdon (E.polyphekion)*
Cod	Yellowspotted grouper	*Epinephelus* sp.
Pit, Duncan, Tamoyi	Bigeye emperor (Large eyed bream)	*Monotaxis grandoculis*
Fafaya	Coral trout/cod (Coronation trout, Lunartail grouper/cod)	*Variola louti*
Grey cod (smaller type = "Opa'a")	Spotted grouper	*Epinephelus maculatus*
Hammerhead uhu	Hammerhead parrotfish	*Scarus microrhinus* (like)
Hi-i	Soldierfish (with white trim to fins)	*Myripristis* sp.
Hu'oo, like Elwyn's trousers	?? Wrasse	*Thalassoma purpureum* (female)
I-hi-i	Crimson squirrelfish	*Myripristis musdjan*
Jack-ass	Dogtooth tuna	*Gymnosarda unicolor*

Pitcairn names	**Common name**	**Scientific name**
Kingi	Amberjack	*Seriola dumerilii* (*S.rivoliana* ?)
Kingi	Yellowtail kingfish	*Seriola lalandi*
Lattis	Common bristle-toothed tang	*Ctenochaetus striatus*
Lattis	Convict tang	*Acanthurus triostegus*
Lattis	Emperor Angelfish	*Pomacanthus imperator*
Lattis	Lemonpeel Angelfish	*Centropyge flavissimus*
Lattis (for all butterfly fishes)	Merten's butterflyfish	*Chaetodon mertensii*
Lattis	Surgeonfish (Tangs)	*Acanthuris* sp.
Lattis	Surgeonfish	*Ctenochaetus spiriatus*
Lattis	Yellow-crowned butterflyfish	*Chaetodon flavocoronatus*
Mami	Sergeant major	*Abudefduf bengalensis*
Mata po'o, Oty and Ann	Flagtail grouper	*Cephalopholis urodelus* (*C.urodeta*)
Maybe "Roundfish"	Jobfish (Reef silvermouth)	*Aphareus furcatus*
Miti	?? Wrasse	*Coris aygula*
Nanwi	Blue sea chub (Nanue, drummer, maomao)	*Kyphosus cinerascens* (*K. bigibbus*)
O'o, Uhu	Parrotfish	*Scarus* sp.
Ofay (but also "Ulwa" as for all other trevallys)	Bigeye trevally	*Caranx sexfasciatus*
Opapa	Honeycomb grouper	*Epinephelus merra*
Pig pig, Leatherjacket, Triggerfish	Black triggerfish	*Hemibalstes chrysopterus*
Pig pig	Picassofish (White barred triggerfish)	*Rhinecanthus aculeatus*
Pig pig, Leatherjackets	Triggerfish	*Balastoides* sp.

Pitcairn names	**Common name**	**Scientific name**
Pit (as it smells)	Goldenline bream (Yellow spot emperor bream)	*Gnathodentex aureolineatus*
Po'ou	?? Wrasse	*Thalassoma purpureum* (male)
Red snapper		*Epinephelus retouti*
Red snapper	Blacktip grouper (Banded grouper)	*Epinephelus fasciatus*
Roundfish (possibly)	Yelloweye opakapaka	*Pristipomoides flavipinnis*
Sandford		*Cheilio inermis*
Speckled cod, Fito cod	Groper (Greasy cod)	*Epinephelus tauvina*
Ta'a'o	Rufous snapper	*Lutjanus rufolineatus*
Tamoyi, Pit, Duncan	Bigeye emperor (Large eyed bream)	*Monotaxis grandoculis*
Trumpet fish	Cornetfish (Flutemouth)	*Fistularia commersonii*
Tu'el	Bluestripe snapper	*Lutjanus kasmira*
Tunny, tuna	Yellowfin tuna	*Thunnus albacares*
Tunu	Red Bass (Twinspot snapper)	*Lutjanus bohar*
Ulwa (most recognised trevally)	Black Jack	*Caranx lugubris*
Ulwa (Ulwa used for all trevallys)	Bluefin trevally	*Caranx melampygus*
Ulwa	Giant trevally	*Caranx ignobilis*
Ulwa (possibly in Pitcairn)	Lalafutu (trevally)	*Carangoides caeruleopinnatus*
Ulwa (possibly in Pitcairn)	Whitemouth trevally	*Uraspis secunda*
Ulwa	Yellow-spotted trevally	*Carangoides orthogrammus*
Wahoo, Coota	Wahoo	*Acanthocybium solandri*
Whistling daughter	Moon wrasse	*Thalassoma lunare*
Yellow cod; Aut cod		*Saloptia powelli*

Other notes:

(from descriptions by Pitcairners and previously recorded notes provided by current teacher)

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Elwyn's trousers - Colour:Orange-pink with dark brown patches. Quite colourful.

Size:Up to approximately 30 cm. 22_25 cm seems to be average.

Elwyn's trousers are usually caught off-shore to around 20 metres. It is not common and not very popular for eating.

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Fafaya:Caught between 20 and 150 metres. Plentiful and good eating - particularly the medium size (around 45 cm).

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Nanwi: -Colour:Grey. Some dark and some light. Occasionally a bright yellow one is caught. Even fewer have a yellow head and grey body and now and then one just has a yellow spot near the tail.

- Size:Up to 55 cm, mostly around 40 cm. Believed larger ones cause some people to have unpleasant dreams.

Nanwi are plentiful, the numbers continuing to increase despite their popularity as a eating fish amongst Pitcairners. They live mostly in large schools which appear to reside in their own particular areas. They can be caught off the rocks using small portions of crab or octopus as bait even though their usual food appears to be seaweed. Can be caught to a depth of 30 metres, very occasionally deeper. The medium sized ones are very good eating though strong in flavour. Most plentiful of edible fish around Pitcairn.

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Oty and Ann (Mata po'o) - Colour:Red with brown to black tail bearing a white "V" stripe on tail.

-Size:Up to approximately 30 cm. Around 20 cm is average.

Mata po'o is caught in 20_40 fathoms. It is quite plentiful in some areas. Is good eating but not popular.

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Red snapper:Caught in 10 to 120 metres. Plentiful and good eating. Though usually small (28_32 cm) they are popular with most Pitcairners. Large ones can reach 50 cm but these are very rare (There is some doubt as to whether this is the same fish, though cannot identify a possible alternative.)

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Whistling daughter -Colour:Blue-green body with blue stripes on yellow/greenish head. Yellow tinges on fins and tail.

Some (believed to be female) have yellow-green body with orange-yellow stripes on greenish head.

- Size:Up to approximately 35 cm but 25_27 cm seems to be average.

Whistling daughter is quite plentiful. Usually caught in shallow water from off rocks and down to 20 m. Not found in schools. Good eating but not popular with all Pitcairners.

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APPENDIX 6: OENO LAGOON BECHE DE MER SURVEY - 9th June, 1994.
(SPC) **Pitcairn Fisheries Resource Survey - 1994**

Numbers of Beche de Mer in each of the quadrants out to 5 metres both sides of a 50 metre transect.

		← 12.5 m →	← 12.5 m →	← 12.5 m →	← 12.5 m →		
Shore ← 350 metres	↑ 5m ↓	0	1	1	0	↑ 5m ↓	→ Reef outer edge 100 metres
	↑ 5m ↓	1	6	3	1	↑ 5m ↓	
% of Sand / Hard / Coral ➢		70 / 20 / 10	10 / 70 / 20	5 / 75 / 20	0 / 75 / 25		
Depth at low tide ➢	1.5 m	1.0 m	0.5 m	0.5 m	0.5 m		

This first assessment was carried out on the western reef. The transect ran approximately perpendicular from shore, roughly west-north-west. Casual observations suggest that density diminishes shorewards and increases more towards the outer reef, decreasing rapidly once at the outer edge of the reef. Again casual observation but on rough estimate the average width of beche de mer productive territory right around Oeno was 150 metres.