SPC
Secretariat of the Pacific Community

Oceanic Fisheries Programme

Issue-Specific National Report 5.2

The potential for interactions between commercial tuna fisheries and Cook Islands artisanal fisheries

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European Commission

MINISTRY OF MARINE RESOURCES
GOVERNMENT OF THE COOK ISLANDS

NEW ZEALAND
MINISTRY OF FOREIGN AFFAIRS & TRADE
Aid Programme

Executive Summary

- At the 2011 SPC HOF, the Cook Islands placed a high priority on an issue-specific national report describing the potential for interaction between regional tuna fisheries and local artisanal fishing. This report is part of a regional series.

- At the scale of the western and central Pacific Ocean, catches for most species have increased dramatically over the past decade. Regional stock assessments indicate that key tuna stocks in subregional waters encompassing the Cook Islands have declined in biomass by up to 58% from a 1980 baseline or by up to 40% from a 2000 baseline. These changes are largely driven by industrial fisheries, including tuna fisheries in other EEZs and on the high seas. Although most of these stocks are not yet fished beyond MSY levels, the availability of these fish to artisanal fisherman has significantly declined, and continues to decline.

- At the scale of the Cook Islands EEZ, there has been a major increase in commercial longlining since 2000, although purse-seine effort continues to be negligible in regional terms. Most of the increase is in the northern group and around Rarotonga.

- Cooks Islands artisanal fisheries data suggest that, for the most part, the industrial and artisanal fleets are targeting different species and interactions are most likely to emerge between the fisheries over the main shared species: yellowfin tuna and wahoo.

- Noting that the economic development of industrial fisheries and protection of local food fisheries present often conflicting objectives, we recommend that Cook Islands consider:

    - At the regional level, encourage the setting of target reference points that promote profitable individual vessel operations rather than maximising catch, noting that any further reductions in tuna and bycatch stock biomass – even if they remain above levels capable of sustaining MSY – are likely to further reduce artisanal catch rates;

    - If an understanding of the relative effects of fisheries and the environment on artisanal fisheries is needed, further develop MMR artisanal data collection systems to enable a more comprehensive Tier 1 analysis (including optimising sampling design and recording fishing areas) and maintain this over time. This would also greatly improve estimates of the contribution of small scale fisheries to food security, employment and GDP. Regional support for sampling design, data maintenance and analysis is available on request.

    - Review the potential pros and cons of expanding industrial fishing exclusion zones to 24nm around all islands, as a precautionary measure.

    - Maintain nearshore FADs to improve access by artisanal fishers to the reduced biomass available when commercial fisheries operate at maximum sustainable yield.

    - Strengthen mechanisms to take into account the views of artisanal fishers in national tuna management planning, and promote artisanal sector priorities in regional fisheries planning. The FFA/SPC DevFISH project has the capacity to provide support for such initiatives.

1. Context

Artisanal fisheries[1] play an important role in food security, family income generation and social wellbeing in the Pacific Islands. The set of species taken by artisanal fisheries often include species caught in larger commercial tuna fisheries, and artisanal fishers often fear that commercial fisheries are reducing local fish availability and impacting artisanal fishers catch rates. A recent Cook Islands report, "Fishing for Answers[2]", documents such views expressed by local artisanal and game fishers.

Many factors, aside from inter-sectoral competition for fish from the same stock, can influence the success of fishing. These include recruitment or natural mortality driven changes in stock abundance and/or changes in local availability of fish due to oceanographic variability. This Issue-Specific National Report (ISNR) provides information to the Cook Islands Ministry of Marine Resources (MMR) to help understand, according the best information currently available, the nature and extent of such interactions as well as the data requirements for effectively monitoring interactions and improving future understanding. This report hopes to assist MMR in planning its approach to monitoring and maintaining small-scale tuna fisheries, in addition to the relatively well-known and data-rich large-scale fisheries that are the main focus of activity. It will be updated in 2014.

2. Approach

The OFP ISNRs on commercial/artisanal interactions address four key questions in each country:

1. Is there an interaction?
2. What is the level and nature of the interaction (or impact by one sector on the other)?
3. What management options (if required) might reduce the likelihood of significant impacts on the artisanal fishery, while minimising impacts on the overall national interest?
4. Are improvements to data collection needed to make informed decisions on this issue?

SPC's capacity to answer the first three questions is directly dependent upon the level of relevant data and information available from both sectors, and this varies significantly between countries. SPC classifies the type of evaluation that can be carried out on fishery interactions into four tiers, based on data availability[3]. All SPC members can receive advice but countries with more comprehensive data will benefit proportionally.

3. Data status review and tier selection

Based on a review of available data (summarized in Table 1), Cook Islands data enables a Tier 2 evaluation of artisanal/commercial interactions. To enable a Tier 1 assessment, data coverage will need to increase, and data be collected that will allow estimation of coverage rates (e.g. vessel activity data). As well as providing more reliable estimates of artisanal catch and effort, a Tier 1 evaluation should be able to clearly distinguish between the impacts of the environment and the impacts of fisheries upon the artisanal fishery and provide firm quantitative input to management plans.

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[1] In this brief we use the term "artisanal fisheries" interchangeably with "small scale fisheries" as defined in the draft FAO "International Guidelines for Securing Sustainable Small-scale Fisheries". They mainly involve small, semi-or non-commercial vessels trolling within the Territorial Sea. (See http://www.fao.org/fishery/ssf/guidelines/en)

[2] Wichman, V (2012) *Fishing for Answers: Socio-economic assessment of the Rarotonga game and small-scale fishing industry*. Ministry of Marine Resources and Cook Islands Fishing Association

[3] See forthcoming SPC Policy Brief on Commercial-Artisanal Fishery Interactions

Table 1 – Summary of data collection programmes, coverage and gaps

	Artisanal	Commercial
Method	Vessel logsheets	Vessel logsheets, Observers
Data types	Catch, effort, size, time, method, location, species	Catch, effort, size, time, method, location, species
Period	2001 – present	Logsheets: 1986 - present Observer: LL: '95,'01,'02,'08 – '10 Observer: PS: US treaty
Coverage estimation	Comparison with estimated total local fish consumption (Table A4)	Comparison with VMS, total catch
Coverage	Uncertain (likely to be low, <20%)	Logsheets: High (86-97% for LL) Observer: Low (LL)
Key data gaps	• 11 of 15 key areas monitored • No data for some year/areas • Effort data not gear-specific • Fishing location rarely provided	• Low observer coverage* • Observer coverage focussed in the southern fishery*

**both of these historical factors are being addressed by MMR, and longline observer coverage is now higher than most zones.*

4. Artisanal/Commercial Interaction Evaluation

The following evaluation of interactions has five parts, which overview the regional and local commercial fisheries (4.1) and the local artisanal fishery (4.2), identify common species/stocks (4.3) and discuss evidence for regional (4.4) and local (4.5) scale interactions.

4.1 Characterisation of commercial tuna fisheries

4.1.1 WCPO Commercial fishery

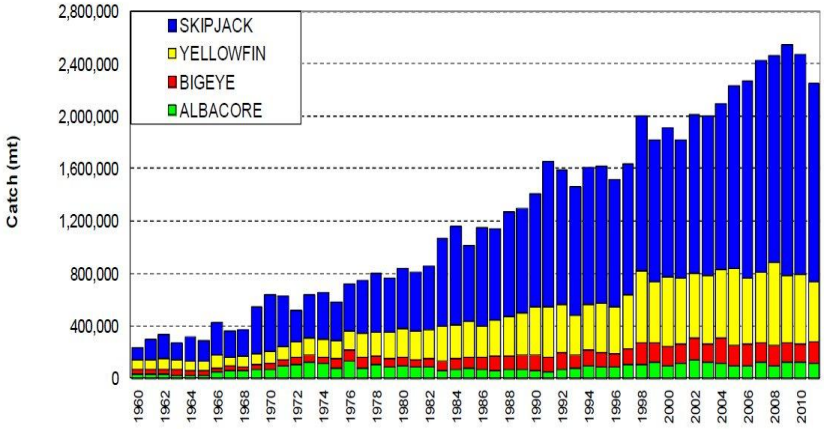

Figure 1a. Catch (metric tonnes) of tuna in the Western and Central Pacific Ocean by species

The commercial tuna fishery in the WCPO is dominated by three main gear types: purse seine, longline and pole-and-line, with other fisheries contributing the remainder of the catch (Figure 1a). Total commercial tuna catch across the WCPO has increased continuously over the past 50 years but may have flattened out at approximately 2.5 million tonnes since 2008 due to a variety of economic, management related and other factors impacting the fishery. Skipjack comprises the majority of the

catch, followed by yellowfin, bigeye and albacore tuna. Observer data indicate that significant numbers of non-tuna species are also caught across the area, predominantly as bycatch.

4.1.2 Cook Islands commercial fishery

The main large scale commercial tuna fishery in the Cook Islands is longlining, targeting predominantly albacore (2005 t to 6,475 t per year since 2005), with a significant catch of yellowfin (177-2,270 t) and bigeye tuna (152-1,191 t) in previous years (Figure 2). There is a minor longline fishery targeting swordfish in the southern group. The Cook Islands EEZ hosts around 5.5% of the commercial longlining effort in FFA island member country EEZs. The density of longlining, in terms of catch per unit area of EEZ, was 29.6 tonnes of tuna per 1000 km^2 in 2011, less than the average regional longline catch per unit of EEZ. The Cook Islands EEZ is not a major focus for the other main commercial tuna fisheries in the region – the surface methods targeting skipjack: purse-seining and pole-and-lining. Averaged over the past 20 years, less than 0.1% of the total regional (FFA island member EEZs combined) purse-seine fishing effort has taken place in Cook Islands waters.

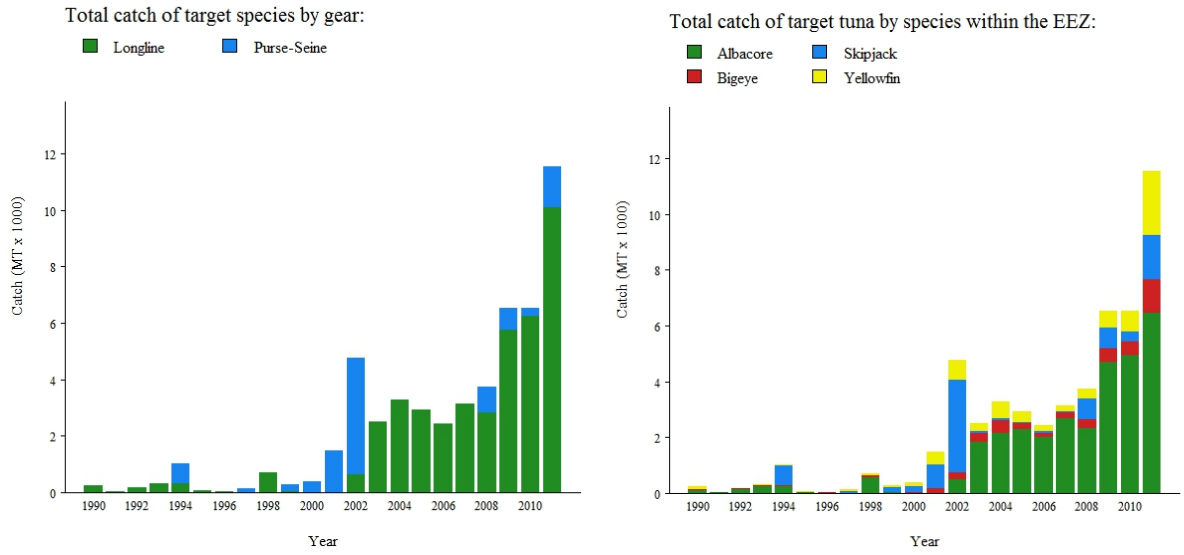

Figure 1b. Catch (metric tonnes) in the Cook Islands by gear (left) and species (right).

4.2 Characterisation of artisanal pelagic fisheries in Cook Islands

MMR has collected data from 11 of 15 islands identified as having artisanal fishing activity (listed in Figure 2). Fishers use predominantly trolling to catch tuna and associated species, but other methods include vertical longline, drop-stone, single-hook drift lines and harpoon. Annual levels of total reported artisanal effort varied considerably among islands and through time (Table A1). Reported effort was highest for Rarotonga, followed by Mangaia, Mitiaro and Aitutaki, and lowest for Manuae, Pukapuka and Takutea. Total reported effort increased up until 2008 (~ 6,000 days). The large annual variation in reported effort and catch for each island is likely due to data not being collected or reported (or for 2010, not entered in the database). The lack of reported effort for Rarotonga, between 2005 and 2007, is one example of this. Household survey information does allow a rough estimate of total fish production, but does not partition the fishery precisely enough by species and by time-period to derive raising factors for the artisanal pelagic fishery data.

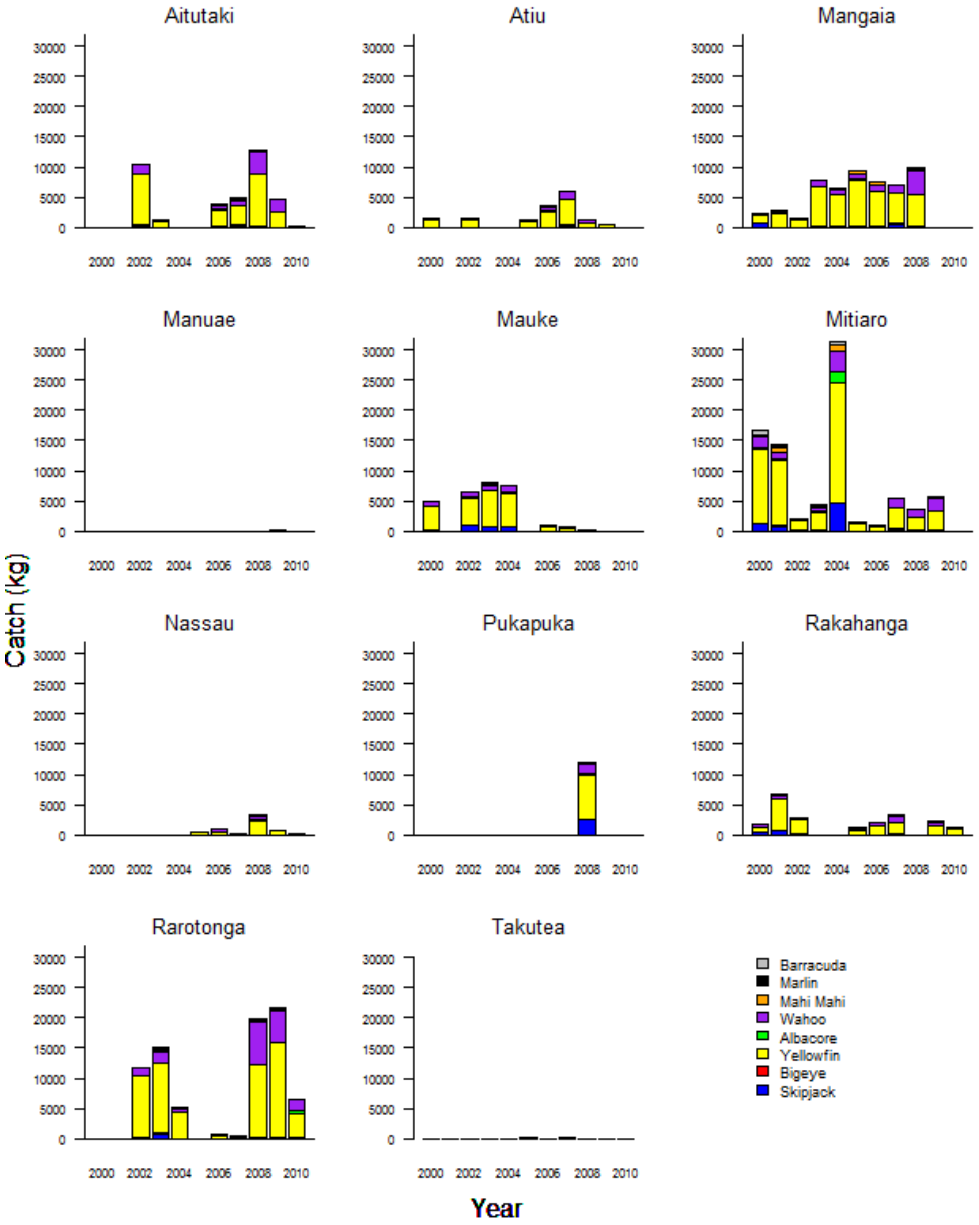

Figure 2. Annual reported unraised catch (kg) of key species from artisanal fisheries on each of 11 islands in the Cook Islands EEZ 2000 -2010.

Similar to effort, annual levels of reported catch varied considerably among islands and through time (Table A2, Figure 2). Reported catch was highest from Mitiaro and Rarotonga, followed by Mangaia and Aitutaki, and lowest from Manuae, Nassau, Takutea and Pukapuka (which had no reported catch for any year except 2008 with 12t). Annual reported total catch increased from 2000 to 2004 (> 50 t), declined substantially in 2005 to 14 t, then increased again to reach peak of over 62 t in 2008 (Table A2). Yellowfin tuna dominates the catch on all islands, comprising between 60 – 100% of each island's reported catch (by vessels trolling outside the reef), and over 70% of the total catch pooled across islands. Wahoo was 13-33% of the total catch for all islands except for Manuae, where only yellowfin were reported, and Pukapuka, where skipjack was the second most commonly-caught species. Skipjack comprised between 9 and 23% of the total reported catch from trolling in Mitiaro, Mauke and Pukapuka. Albacore, bigeye tuna, mahimahi, marlin and barracuda were also reported in the catch from most islands, but together represented less than 6% of the fisheries catch. Dogtooth tuna, rainbow runner, trevally, and sailfish were also reported in very low numbers.

4.3 Identifying common species and stocks

Based on a review of catch data (see table A3), 7 species were identified as common to both sectors. Yellowfin and wahoo are the most important (by proportion of catch) to the artisanal fishery, and yellowfin are also caught in significant numbers in the commercial longline fishery.

A review of information related to movements, mixing rates (e.g. maximum tag-recapture distances, and mean distance of recapture after 24 months) and stock structure for each of these species indicated that for common species for which relevant movement information was available, average dispersal over two or more years exceeds 200 nm (and sometimes much further) and therefore that the artisanal and local (EEZ) commercial fisheries are fishing on the same stocks. For tuna and billfish species it is likely that there is a geographical potential for interaction between artisanal fisheries and commercial fisheries operating in adjacent EEZs and high seas areas, but this is less likely for mahimahi and wahoo about which less is known. The interaction potential between Cook Islands artisanal fisheries and commercial fisheries in more distant part of the WCPO is uncertain and likely to be species specific. It is likely to be effective over much longer timescales. It should be noted that there is some evidence that components of regional tuna stocks may show some coastal residency but it is not yet known how significant this might be.

4.4 Regional level interactions

Unsurprisingly, stock assessments indicate that fishing in the WCPO has reduced the spawning biomass of the four main tuna species below the amount that would be present today if fishing had never occurred. The reduction in total spawning biomass relative to the levels estimated in the absence of fishing, is 35% for skipjack, 66% for yellowfin, 77% for bigeye and 40% for albacore tuna.

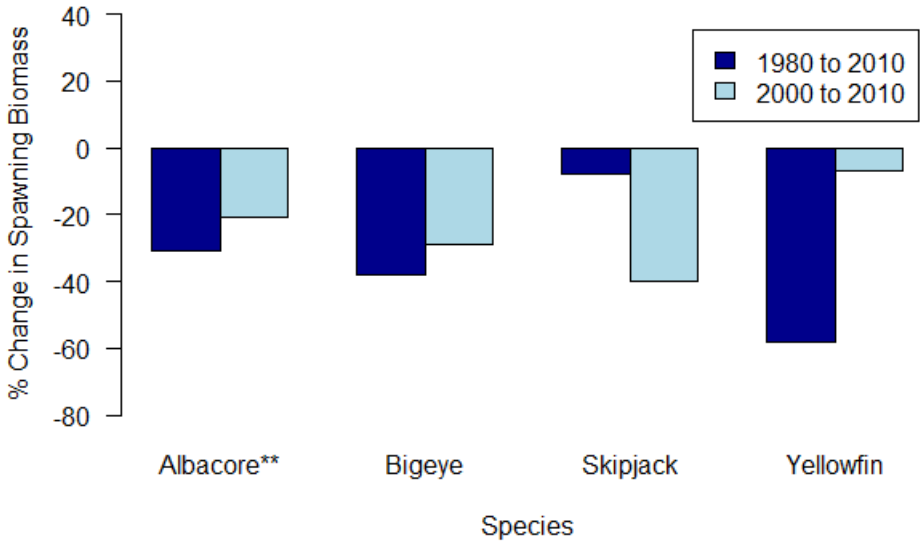

Figure 3. Percentage change in spawning biomass since 1980, and since 2000, in the stock assessment model regions overlaying the Cook Islands EEZ (for skipjack, bigeye and yellowfin) or for the entire model region (for albacore tuna).

In the model subregions encompassing the Cook Islands EEZ, this depletion has been estimated at 8% (skipjack), 58% (yellowfin) and 38% (bigeye) since 1980, and 40% (skipjack), 7% (yellowfin) and 29% (bigeye) since 2000 (Figure 3). The south Pacific albacore assessment, which does not estimate depletion by subregion, indicates that albacore depletion in the entire model region since 1980 and 2000 is 31% and 21% respectively.

These model results indicate that the Cook Islands artisanal fishery has significantly fewer skipjack, bigeye, yellowfin and albacore available to it since the industrial fishery started, and that significant declines in biomass have occurred even in recent years (since 2000) for albacore, bigeye and skipjack in particular. Although none of these stocks are yet considered overfished, assessments predict that bigeye tuna will become overfished in the WCPO unless fishing mortality for this species is further reduced. However, biomass of yellowfin, which is the main species of interaction between artisanal and commercial fisheries in the Cook Islands, is declining at a lower rate than in previous decades, and may have even increased slightly since 2000 in certain parts of the region.

4.5 Local (EEZ) level interactions

Understanding the factors that influence artisanal catches may assist in determining if management action is possible or required. The following sections look at what "local" factors can impact artisanal catch rates; whether there is evidence that the local commercial fishery is having a substantial impact, and; other data/information relevant to local management options discussion.

4.5.1 Local factors impacting artisanal catch rates

Local factors impacting upon the availability of fish to artisanal fisheries can be divided into three main categories:

1) **Competing fisheries** - e.g. local commercial fisheries, as previously discussed
2) **Recruitment variability** – climate driven variability in oceanography has significant impacts on the survival of eggs, larvae and juvenile fish and can cause fluctuations in local recruitment of pelagic fish species over time, leading to variability in local biomass and catch rates.
3) **Oceanography impacts on movement** – Climate linked changes in ocean currents and conditions (e.g. current speeds, temperatures, direction, location, depth, upwellings, convergences, areas of productivity and prey availability) can lead to changes in the vertical and horizontal distribution of tuna and other pelagic species that may subsequently affect their availability to fishing gear and impact upon fishery catch rates. Unfortunately, artisanal fisheries in general are very susceptible to changes in catch rates associated with oceanographic shifts. Compared to commercial fisheries, they have a limited capacity to follow shifting areas of high fish availability.

4.5.2 Spatial aspects of the potential for interaction

Information pertaining to how close commercial vessels fish to artisanal fishing grounds, how much catch they take in those areas, and which ports have the highest likelihood of interaction, may assist the Cook Islands government in considering if and how it would like to manage this issue. The following data summaries are based on commercial longline logsheet data, which, while assessed to have high coverage, underestimates total catch and effort, because all vessels do not always submit logsheets. Longline observer coverage is too low to use for assessing potential spatial interactions.

Proximity of commercial fishing effort to artisanal fishing grounds

The distribution and intensity of commercial fishing effort throughout the Cook Islands EEZ and relative to artisanal fishing areas, provides an indicator of areas with a higher *potential risk* of significant interactions with the commercial fishery.

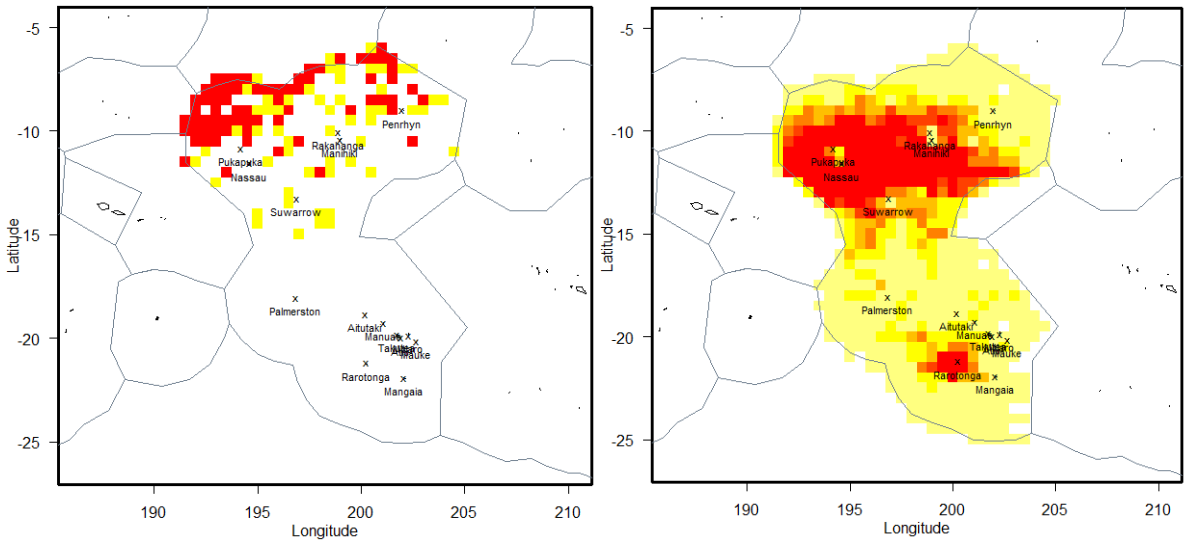

Figure 4. Distribution of purse seine sets (left) and number of longline hooks (right) in the Cook Islands EEZ for all fleets combined for the period 1990–2010.

Purse seine effort was low and confined to north of 15°S (Figure 4). Within that area, effort was higher near Pukapuka and Penrhyn than it was near other artisanal fishing areas. Longline fishing effort was concentrated between 8-15°S and in a small area south of 20°S (Figure 4). Longline fishing effort was higher close to Pukapuka, Nassau, Rakahanga, Manihiki, Suwarrow and Rarotonga than around the other islands.

Commercial catch levels close to artisanal fishing grounds

The size of the commercial tuna catch taken within successively wider radii from artisanal centres assists in understanding the potential effects of different sizes of commercial exclusion zone. The total amount of commercial catch taken in proximity to artisanal ports was relatively low from 1991-2001, but has remained relatively high since. Within 25 km of these areas, the sum of the

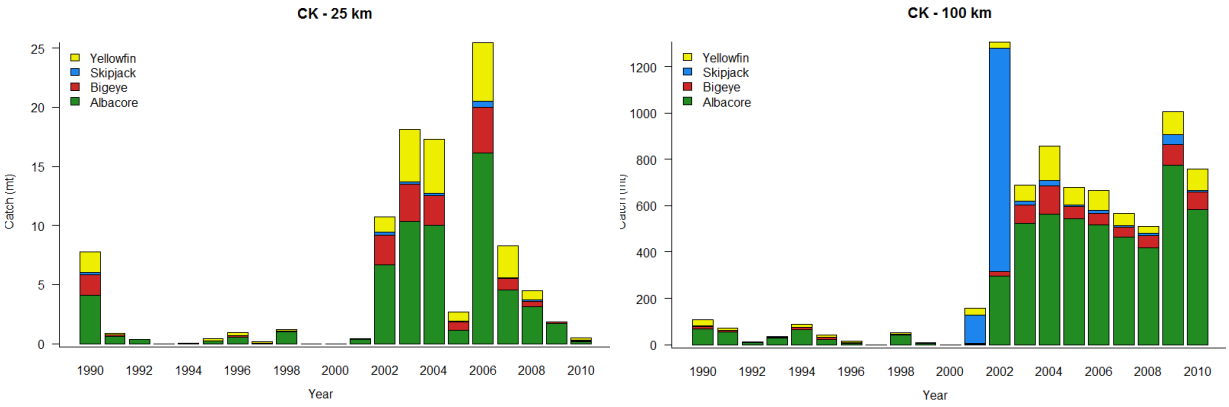

Figure 5. Total annual commercial catch (longline and purse seine combined) of yellowfin, skipjack, bigeye and albacore tuna within a distance (25 km, 100 km) from artisanal ports in the Cook Islands EEZ. Note that logsheet data are unraised and may underestimate catches to a degree. Logsheet coverage rates in recent years are relatively high.

annual commercial catches (longline and purse seine combined) across all artisanal ports and species was very low (<25 t/yr), and declined very significantly in recent years. Within 50 km, the maximum annual catch was 350 t, while a maximum catch of 1,300 t was reported within 100 km of all islands. The majority of the commercial catch is albacore tuna, aside from the large purse seine catch of skipjack in 2002. Yellowfin comprises the next most significant commercial species catch.

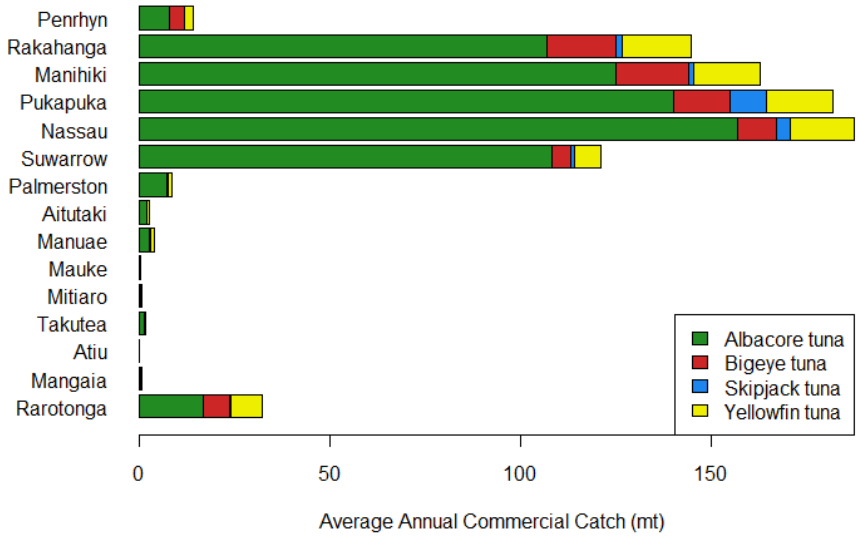

Figure 6. Annual total commercial catch (t) (longline and purse seine combined) of yellowfin, skipjack, bigeye and albacore tuna from 2006 to 2010 within a 100 km radius of different artisanal fishing areas in the Cook Islands EEZ.

The level of commercial catch taken within 100nm of each artisanal fishing area (Figure 6) was estimated to help identify islands at higher *potential* risk of immediate interaction with the commercial fishery (noting that this does not provide *evidence* of an actual impact on artisanal catch rates). The average annual commercial longline catch taken within 100 km of shore (from 2006-2010) was highest for the islands of Nassau, Pukpuka, Manihiki, Rakahanga, Penrhyn and Suwarrow, which are located in the north of the Cook Islands EEZ. Very low commercial catches were reported near all other islands, except the main island of Rarotonga.

There were no strong differences in the composition of commercial longline catch between artisanal fishing areas, with albacore tuna (the main commercial species) and yellowfin (the key artisanal species) comprising 5-15% of commercial catch near islands. However, the proportion of yellowfin and bigeye tuna was consistently higher in commercial catches taken within 25km than in catches taken within 100km of shore. Longliners targeting albacore apparently operate further out in the EEZ than shallower-setting, and probably shorter trip-time, longliners targeting other species.

Limited artisanal size data indicate that size of yellowfin caught by the dropstone method (no size data was available from artisanal troll fisheries) is well within the range of sizes taken in the commercial longline fishery.

4.5.3 Evidence for local commercial sector impacts

Separating the effects of oceanography and recruitment from commercial fishery impacts has proven to be a very difficult task in the past and one which typically requires fine-scale CPUE data from artisanal fisheries. Unfortunately, MMR does not yet have access to a fine-scale CPUE time-series describing the artisanal fishery with sufficient coverage. Hence, while it is clear that regional fisheries have reduced the stock biomass, and that Cook Island artisanal catch rates of the main shared species identified by the data analysis (particularly yellowfin and wahoo) are likely to be lower than in the absence of a commercial longline fishery in the WCPO – **quantitatively assessing the impact of the local commercial fishery on local artisanal catch rates, versus environmental and recruitment effects, is not possible at this stage.** This report is thus about the likelihood and *potential* for interaction. Some recommendations for managing this potential are presented in the Executive Summary.

Appendix A: Supplementary information

Table A1. Annual reported effort (number of days fished) by artisanal fisheries on each of 11 islands in the Cook Islands EEZ 2000–2010. Source, Cook Islands artisanal data held by SPC and the Cook Islands Ministry of Marine Resources. Estimates are based on unraised data and do not take into account different gear types used. Aitu = Aitutaki, Mang = Mangaia, Manu = Manuae, Mauk = Mauke, Miti = Mitiaro, Nass = Nassau, Puka = Pukapuka, Raka = Rakahanga, Raro = Rarotonga, Taku = Takutea.

Year	Aitu	Atiu	Mang	Manu	Mauk	Miti	Nass	Puka	Raka	Raro	Taku	Total
2000	0	76	176	0	301	512	0	0	64	0	0	**1129**
2001	2	0	380	0	0	1109	0	0	425	0	0	**1916**
2002	768	148	129	0	302	128	0	0	342	1089	0	**2906**
2003	150	0	854	0	423	323	0	0	0	1710	0	**3460**
2004	5	0	757	0	278	1032	0	0	0	400	0	**2472**
2005	0	194	1627	10	0	230	68	0	194	0	10	**2333**
2006	447	619	976	0	150	82	160	0	276	64	8	**2782**
2007	716	764	952	0	108	656	25	0	373	51	16	**3661**
2008	1210	154	1024	6	47	237	292	496	0	2439	8	**5913**
2009	454	39	0	26	0	556	93	0	379	2907	0	**4454**
2010	25	0	6	0	0	0	25	0	134	709	0	**899**

Table A2. Annual reported total catch (metric tonnes) of all major species combined caught by artisanal fisheries on each of 11 islands in the Cook Islands EEZ 2000–2010. Source, Cook Islands artisanal data held by SPC and the Cook Islands Ministry of Marine Resources. Estimates are based on unraised data. Aitu = Aitutaki, Mang = Mangaia, Manu = Manuae, Mauk = Mauke, Miti = Mitiaro, Nass = Nassau, Puka = Pukapuka, Raka = Rakahanga, Raro = Rarotonga, Taku = Takutea.

Year	Aitu	Atiu	Mang	Manu	Mauk	Miti	Nass	Puka	Raka	Raro	Taku	Total
2000	0	1.4	2.3	0	5.0	16.7	0	0	1.9	0	0	**27.3**
2001	0	0	2.8	0	0	14.2	0	0	6.8	0	0	**23.8**
2002	10.4	1.6	1.4	0	6.5	2.0	0	0	2.9	11.8	0	**36.6**
2003	1.2	0	7.8	0	8.0	4.4	0	0	0	15.2	0	**36.6**
2004	0	0	6.4	0	7.6	31.2	0	0	0	5.1	0	**50.3**
2005	0	1.2	9.5	0	0	1.5	0.5	0	1.2	0	0.1	**14.0**
2006	3.9	3.7	7.6	0	0.9	0.9	1.1	0	2.0	0.8	0	**20.9**
2007	4.9	6.0	7.1	0	0.6	5.4	0.1	0	3.5	0.4	0.1	**28.1**
2008	12.7	1.2	9.8	0	0.3	3.7	3.3	12.0	0	19.8	0.1	**62.9**
2009	4.7	0.4	0	0.1	0	5.7	0.8	0	2.2	21.6	0	**35.5**
2010	0.2	0	0	0	0	0	0.1	0	1.3	6.5	0	**8.1**

Table A3 – Summary of common species taken in both artisanal tuna sector and the commercial longline fishery in Cook Islands, including relevant information on movement, mixing and stock structure.

Most Common Species (taken in both fisheries)*	Proportion of fishery catch (2006-2012)		Max. Distance Reported (nm) (validated/all)[3]	Mixing information	Pacific Stock Structure
	Artisanal	Commercial			
Yellowfin	63.42	11.29	4055/9470 (7)	PR500 ~45% (3); MRD24[1] = 374nm (7)	WCPO; EPO
Albacore	1.33	72.85	~3500 (5)	Latitudinal shifts; MRD24[1] = 488nm (7)	NPO; SPO
Bigeye	0.72	8.66	4560/8998 (7)	MRD24[1] = 604nm (7)	Pan Pacific
Skipjack	3.77	1.14	7031/9446 (7)	PR500 ~35% (3); MRD24[1] = 443nm (7)	WCPO; EPO
Wahoo	25.14	~1[4]	1707 (9)	Uncertain	SWPO; EPO (8)
Blue marlin	0.27	1.41	8041 (6)	Majority global recapt <1500nm up to 5 yrs (6)	Pan Pacific (?)
Mahi mahi	2.32	~1[4]	1356 (10)	Uncertain	Uncertain

** See appendix for full list of species taken in both fisheries. Those not listed here are very minor components*

1 - MRD24 - Mean recapture distance after 24 months from release (validated records)

2 - PR500 - Percentage of recaptures after 18 months (from release) that are more than 500nm from release point

3 - Uses data from Pacific where possible but not for mahi mahi

4 - Observer data not representative of whole fishery species proportions. Used logsheet data, but added wahoo, mahi mahi from observer data.

Table A4: Indicative annual catch of pelagic species estimated as being landed at each island from artisanal fisheries, based on national census, average fish consumption, and fishery source (oceanic/coastal). These very approximate island estimates are for the purpose of testing the reasonability of data derived from artisanal fisheries surveys, ***and should not be used as a basis for reporting or planning***.

Island	Human population 2011	kg consumed stratified urban/rural	Oceanic catch estimate (kg)
Rarotonga	13,097	327,425	98,228
Aitutaki	2,035	124,135	37,241
Mangaia	573	34,953	10,485
Atiu	481	29,341	8,802
Mauke	307	18,727	5,618
Mitiaro	189	11,529	3,458
Manihiki	243	14,823	4,446
Penrhyn	203	12,383	3,714
Rakahanga	77	4,697	1,409
Pukapuka	453	27,633	8,289
Nassau	73	4,453	1,335
Palmerston	60	3,660	1,098
Suwarrow	0	0	0
Takutea	(uninhab)	0	0
Manuae	(uninhab)	0	0
Cook Islands Total	**17,791**	**613,759**	**184,128**

Parameters used to generate consumption and catch estimates above

Rural fresh fish consumption	61 kg/yr/person
Urban fish consumption	25 kg/yr/person
Percentage pelagics in fish consumed	30%