SCIENTIFIC COMMITTEE
FIFTEENTH REGULAR SESSION

Pohnpei, Federated States of Micronesia
12 – 20 August 2019

PROJECT 90 UPDATE: BETTER DATA ON FISH WEIGHTS AND LENGTHS FOR SCIENTIFIC ANALYSES

WCPFC-SC15-2019/ST WP-03

Oceanic Fisheries Programme (OFP)
Pacific Community (SPC)
Noumea, New Caledonia.

TABLE OF CONTENTS

1. INTRODUCTION

1. The Fifteenth Regular Session of the WCPFC (WCPFC15; Anon., 2018) approved Project 90 to be conducted over three years (2019–2021); the agreed plan for Project 90 is shown in ANNEX 1.

2. Williams and Smith (2018) provide more detail on the rationale for Project 90 and this brief paper provides an update of activities under Project 90 in the first six months of 2019 and an indication of the planned activities in the short-medium term.

2. PROJECT 90 WORK TO DATE

3. Table 1 in ANNEX 2 provides an indication of progress with activities under Project 90 as at July 2019. In summary, the main work conducted to date has been –

- (i) the establishment of a conversion factor database tables,
- (ii) scoping and gap analysis (within SPC) to determine the priority areas to collect conversion factors data under the project, and
- (iii) initial contact with some CCMs in regards to conducting the field work required to collect the necessary data to generate the required for conversion factors.

4. In addition to establishing the conversion factors database, there has been some work with the initial population of this database (with available conversion factor data), which include data from :

- Conversion factor data submitted to, acquired or generated by SPC in the past;
- Various shark species conversion factor data compiled and presented in Clarke et al., (2015);
- Australian longline fishery (R. Campbell, pers. comm.).

5. Example outputs from the current version of the conversion factor database are provided in ANNEX 3, noting (i) the research and population of available conversion factor data are ongoing; (ii) work on enhancing the data, including more detail on source and general quality control, is not yet complete, and (iii) the system to disseminate conversion factor data is considered a prototype and will be enhanced in the future.

6. SPC-OFP scientists were consulted to provide advice on gaps in conversion factor data that would improve the information available for the work of the Commission (primarily stock assessments), and this advice has been taken into account in the proposed work plan (see Section 3). [Member countries are also requested to review progress and the proposed work plan for the remainder of this year and 2020, and provide their advice on the priority areas suggested.]

7. Delays in the commencement of the fieldwork component of Project 90 were anticipated, as there remains preliminary work required to scope and prioritize the data to be collected, and review/update protocols for data collection, for example. Most important for the fieldwork component is the initial engagement of interested member countries through formal arrangements to ensure they are adequately resourced to conduct the fieldwork required under this project. In any event, we expect some of the fieldwork to start before the end of 2019.

8. Table 1 in ANNEX 2 also provides an indication of the short-medium term work required under the project (see the text in red), acknowledging more detail will be provided after feedback and review of the initial data collection has been undertaken (i.e. targeting SC16).

3. RECOMMENDATIONS

9. SC15 is invited to review and comment on the progress made on Project 90 activities at this stage. If required, we suggest a SC15 small working group convene to discuss and enhance the priorities and activities proposed in ANNEX 2.

REFERENCES

Anonymous. 2018. Report of the Fifteenth Regular Session of the Commission for the Conservation and Management of Highly Migratory Fish Stocks in the Western and Central Pacific Ocean. 10–14 December 2018, Honolulu, Hawaii, USA. Western and Central Pacific Fisheries Commission, Pohnpei, Federated States of Micronesia.

Clarke et al. 2015. Report of the Pacific Shark Life History Expert Panel Workshop, 28-30 April 2015; SC11-EB-IP-13. Eleventh Regular Session of the WCPFC Scientific Committee (SC11), Pohnpei, Federated States of Micronesia. 6–15 August 2015.

Williams, P.G, & N. Smith. 2018. Requirements for enhancing conversion factor information. SC14 ST-IP-05. Fourteenth Regular Session of the Scientific Committee of the WCPFC (SC14). Busan, Republic of Korea. 8–16 August 2018.

ANNEX 1 – Agreed plan for Project 90 to acquire better data to determine fish length/weight

<table>
<tr><th>PROJECT 90</th><th>Better data on fish weights and lengths for scientific analyses</th></tr>
<tr><td>Objectives</td><td>This project has three objectives

The first component aims to identify gaps, address those gaps which can be resolved with existing information, and develop the sampling plan and protocol to resolve remaining gaps, through the following activities (but not limited to):
• identify the priority gaps in conversion factor data for the WCPFC key tuna species, key shark species, and key billfish species;
• expand the conversion factors to cover the WCPFC key shark species for groups: mako, thresher and hammerhead shark and determine the data needs for these groups after gap analysis against existing conversion factors;
• produce a list of species of special interest (SSIs, excluding key shark species) that require conversion factor data;
• produce a list of commercially important bycatch species (not covered in the items above);
• include more information on source of data for each conversion factor (e.g. reference of study, sample size, R2, minimum/maximum size of sample, etc.) in tables of conversion factors. This will also inform the need for more data collection for particular species or groups;
• produce a list of the remaining bycatch species that require conversion factor data;
• produce standard protocols for conversion factor data collection to be collected by observers and port samplers;
• prioritize this list so that the most important work is achieved; and
• present the findings at SC15 for review, acknowledging that some observer providers will voluntarily collect conversion factor data prior to SC15.

The second component relates to investigating potential innovative methods to obtain length-length conversion factor data, including:
• explore the use of EM tools to obtain morphometric length measurements from fish e-measured by EM Analysts.

The third component relates to collecting the conversion factor data:
• systematically collect representative samples of length measurements of bycatch species to support future estimation of fish bycatch in the WCPO; and
• systematically collect length:length, length:weight and weight:weight data on all species to better inform future estimation of fish bycatch in the WCPO.</td></tr>
<tr><td>Note</td><td>Although these three objectives are distinct, they have been combined into a single project to avoid any possible duplication of effort and, as there will likely be combined tasking of Pacific Island observers and port-samplers, in future data collection arising from the project.

The project acknowledges that flag state CCMs with national port sampling and observer programmes may also want to collect conversion factor data using the standard protocols established under this project; these initiatives would be an invaluable contribution to the project.

The project will also involve the work in transferring the conversion factor information compiled from other sources, such as the information presented in Clarke et al. (2015) Report of the Pacific Shark Life History Expert Panel Workshop, 28-30 April 2015; SC11-EB-IP-13, and conversion factor data compiled from the Australia domestic longline fishery.

Project 90 implementation acknowledges that issues of observer safety, overall workload and work conditions are paramount. The development of the data collection protocols for conversion factor measurements through observers should take into account the challenges with on-board observer activities, including, but not limited to;</td></tr>
</table>

PROJECT 90	**Better data on fish weights and lengths for scientific analyses**
	- Potential difficulty in measuring large specimens on small boats; - Evaluating the feasibility of weighing fish at sea. For example, consideration of the following: • Ensure any weighing equipment does not hinder the fishing operation. • Simplifying the process of any onboard weight measurements; • To what extent the assistance of the crew will be expected, and • Avoiding duplicate weighing of specimens by keeping and weighing removals. - Note that any sharks which fishers are not allowed to retain will not be in the observer protocol for this project.
Rationale	Estimates of bycatch are currently collected through the ROP in units of number, weight or both. In order to convert from numbers to weight, and vice versa, it is necessary to have information on both the size of caught individuals, and appropriate length:weight relationships for the species in question. This conversion between numbers and weight allows analyses of bycatch data to use the full observer dataset, rather than a subset with a consistent unit of measurement, therefore maximising the utility of the bycatch data recorded by observers. Furthermore, bycatch length data allows for consideration of the life-stages of individuals. This information could be of particular interest when considering bycatches of SSIs. There are currently insufficient, or unrepresentative, length samples for species caught in purse seine and longline fisheries, with the exception of bigeye, yellowfin and bigeye in purse seine catches, which are sampled through observer grab samples. This project would fill this data gap. At least SEVEN (7) Pacific Island member countries with observer programmes have expressed interest in participating in conversion factor data collection, as long as funding support is available to cover any reasonable request for the additional work required by observers and port samplers. Accordingly, this project addresses objectives arising from discussions at SC13 about the results of regional estimates of purse seine and longline bycatch (Peatman et al., 2017; Peatman et al., 2018a; Peatman et al., 2018b). As a result of the discussions in 2017, SC13 recommended that the Scientific Service Provider be tasked with: • designing and co-ordinating the systematic collection of representative samples of length measurements of bycatch species; and • a project to design and co-ordinate the systematic collection of length:length, length:weight and weight:weight data on all species to better inform bycatch estimation.
Assumptions	Achievement of the objectives is subject to the following assumptions: • sufficient data are available to support the sampling design analyses; • sampling designs can be developed which are statistically robust and would support future estimation of fish bycatch in the WCPO; • current observer equipment (e.g. calipers) is suitable for the length sampling protocols; • suitable and cost-effective equipment can be sourced for robust weight data collection; • data collection can be integrated into existing sampling events in-port and at-sea;. • resources are available within selected countries to undertake this work; and • the sub-regional DCC observer conversion factors form will be the basis for data collection.
Scope	The proposed work programme comprises: • data compilation activities; • subsequent statistical analysis activities to design future sampling approaches; • evaluation of designs for practical field application; • trials of selected sampling approaches in the field along with trials of equipment required to complete the sampling designs; • finalisation of future sampling protocols; • development of associated training standards;

PROJECT 90	Better data on fish weights and lengths for scientific analyses
	• incorporation of training into trainer trainings and biological sampling trainings as required; • ongoing co-ordination of sample collection and data submission; and • reporting on designs and progress with implementation and data collection. It is intended that a preliminary report would be prepared for SC15 and a more comprehensive report for SC16 and a final report at SC17.
Timeframe	33 months (from January 2019 through September 2021)
Budget	2019 US$60,000 2020 US$30,000 2021 US$20,000 Note that this funding is intended to cover the work of the Scientific Services Provider in the design and co-ordination of this work. This will cover the analytical components identified in the scope of the project. It will also cover trials of methodologies identified at-sea and in-port. The funding in 2019 includes the costs to cover the additional work for selected observers from some observer providers, which will inform the process for refining the budget for this project in subsequent years. The 2019 funding also includes the costs to investigate and purchase 1-2 weighing devices in the initial implementation phase. It does not cover the costs of CCMs in implementing the protocols or the purchase of related equipment. This will require co-funding or additional funding depending on the designs selected in the design and testing phase and may require additional requests for funding from SC15.
References	Peatman, T., Allain, V., Caillot, S., Williams, P., and Smith, N. 2017. Summary of purse seine fishery bycatch at a regional scale, 2003-2016. SC13-ST-WP-05. Thirteenth regular session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Rarotonga, Cook Islands, 9-17 August 2017. Peatman, T., Bell, L., Allain, V., Caillot, S., Williams, P., Tuiloma, I., Panizza, A., Tremblay-Boyer, L., Fukofuka, S., and Smith, N. 2018a. Summary of longline fishery bycatch at a regional scale, 2003-2017. SC13-ST-WP-02. Fourteenth regular session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Busan, Republic of Korea, 8-16 August 2018. Peatman, T., Allain, V., Caillot, S., Park, T., Williams, P., Tuiloma, I., Panizza, A., Fukofuka, S., and Smith, N. 2018b. Summary of purse seine fishery bycatch at a regional scale, 2003-2017. SC13-ST-IP-04. Fourteenth regular session of the Scientific Committee of the Western and Central Pacific Fisheries Commission. Busan, Republic of Korea, 8-16 August 2018.

ANNEX 2 – Progress on Project 90 activities as at July 2019

Table 1. Progress on Project 90 activities as at July 2019 (red text indicates anticipated short-medium term work yet to be undertaken)

Activity #	Activity description	Progress as at July 2019
1.1	Identify the priority gaps in conversion factor data for the WCPFC key tuna species, key shark species, and key billfish species	i. Length–Weight (UF:WW – see ANNEX 4) data for oceanic tuna less than 30cm. ii. Weight–Weight (WF:WW – see ANNEX 4) for adult yellowfin and bigeye tuna to provide a better understanding in weight loss between fresh/ice and (flash) frozen tuna. iii. Length–Length conversion factor data (SD:UF; PS:UF – see ANNEX 4) for adult yellowfin and bigeye tuna from the longline or handline fisheries ((to obtain conversion factors that could be applied to frozen fish without tails). iv. The following conversion factor data to be collected from WCPFC key shark species, where relevant. o Length–Weight (At least, obtaining UF:WW and TL:WW of individual shark); o Length–Length measurements (combinations of UF, TL, SD and PC of individual shark); o Weight–Weight measurements (where possible and with permission, at least WW:TT, WW:FN). v. The following shark species/fishery combination are to be targeted for data collection: o Blue shark in the longline fishery; o Silky shark in the purse seine fishery (only dead individuals can be sampled before they are discarded); o Oceanic whitetip shark in the purse seine fishery (only dead individuals can be sampled before they are discarded); o Mako shark (at species level) in the longline fishery; o Thresher shark (at species level) in the longline fishery; o Hammerhead shark (at species level) in the longline fishery; o Whale Shark : Length–Length (PD:TL; PD:UF; only dead individuals noting 'best handling practices' should avoid mortalities; also, the challenges in obtaining measurements of large individuals will require some innovative thought (e.g. the potential for observers using laser measurement devices). Length–Weight conversion factors for whale shark are very important, but considered unrealistic at this stage. vi. For billfish species, Length–Length and Length–Weight conversion factor data for south Pacific swordfish and striped marlin (broken down by sex) have been identified as priorities, noting that conversion factor data for other billfish species will be collected as the opportunity arises.
1.2	Expand the conversion factors to cover the WCPFC key shark species for groups: mako, thresher and hammerhead shark, after gap analysis against existing conversion factors	i. The conversion factor (CF) database has been established, and some of the available conversion factor data entered (e.g. data compiled and presented in Clarke et al., 2015). ii. A web-based system to enter conversion factor data has been established and a prototype system for viewing and disseminating data conversion factor data has been established (see ANNEX 3). iii. Continue research to populate the CF database top resolve the gaps in SOURCE and COMMENTS fields of current records. The COMMENTS field will potentially contain the most important information – where samples came from and ranges of samples, and so consider expanding the CF database to have more defined searchable fields, particularly if this the CF database is to be used to help define the gaps. iv. Further conversion factor information to be added, as it becomes available through Project 90, or submitted to the WCPFC, or identified through literature research (for example).
1.3	Produce a list of species of special interest (SSIs, excluding key shark species) that require conversion factor data	i. The following conversion factor data to be collected from the SSIs (excluding key shark species) where possible: o Manta/Mobulids : Length–Weight (TW:WW; only dead individuals noting 'best handling practices' should avoid mortalities; also, the challenges in weighing/measuring large individuals will require some thought) o Marine Mammals : Length–Length (*CF measurements to be determined*; only dead individuals noting 'best handling practices' should avoid mortalities; also, the challenges in obtaining measurements of large individuals

Activity #	Activity description	Progress as at July 2019
		will require some innovative thought (e.g. the potential for observers using laser measurement devices). Length–Weight conversion factors for marine mammals are very important, but considered unrealistic at this stage. ii. No other priorities proposed at this stage, acknowledging that compiling interactions in numbers is generally preferred, and the weights of most non-shark SSIs is rarely required.
1.4	Produce a list of commercially important bycatch species (not covered in the items above)	i. The following conversion factor data to be collected from Mahi mahi, Wahoo and Opah in the longline fishery, as the initial priority: a. Length–Weight : (UF:WW); b. Weight–Weight : (GG:WW, GX:WW; FW:WW); c. Length–Length : (UF:PF).
1.5	Include more information on source of data for each conversion factor (e.g. reference of study, sample size, R^2, minimum/maximum size of sample, etc.) in tables of conversion factors, which will inform the need for more data collection.	i. The conversion factor database has been established and this work has commenced (see ANNEX 3 for provisional conversion factor data).
1.6	Produce a list of the remaining bycatch species that require conversion factor data.	i. Length–Weight (UF:WW; TL: WW) for common bycatch that are typically discarded at sea, or are kept for crew consumption (but not generally commercially viable), including: Barracuda species, Lancetfish species, pomfret species.
1.7	Produce standard protocols for conversion factor data collection to be collected by observers and port samplers.	i. The protocols and conversion factor data collection forms exist for observers, but have yet to be reviewed and updated to cater for the data collection requirements under Project 90 activities 1.1 through 1.6 ii. The protocols and conversion factor data collection forms for Port Samplers have yet to be designed and established.
2.1	Explore the use of EM tools to capture multiple length measurements from fish e-measured by EM Analysts.	i. One CCM currently generating data from an E-Monitoring system has been informally approached to collect Length–Length conversion factor data (using the EM digital measuring tool) from bigeye and yellowfin tuna to compare with existing conversion factor formulae for these species. ii. This work will inform the feasibility of EM to collect certain Length–Length conversion factor data for other species.
3.1	Systematically collect representative samples of length measurements of bycatch species to support future estimation of catches in the WCPO	i. This activity is currently undertaken through observers, although it acknowledges the potential of E-Monitoring to augment the available observer size data for bycatch species, particularly large individuals and live key shark species, which are difficult to measure.
3.2	Systematically collect Length–Length, Length–Weight and Weight–Weight conversion factor data of WCPFC key species and other species (non-shark SSIs and other bycatch species) to better inform future estimation of catches in the WCPO.	i. The collection of conversion factor data is included as an activity on the current tagging cruise. ii. The following monitoring areas have been identified for conversion factor data collection in the first instance: o A port with unloadings of both small oceanic tuna and large yellowfin tuna (for Activities #1.1–i and #1.1–iii); o Longline fisheries with observer coverage in three Pacific Island countries (for Activities #1.1–ii thru vi which are relevant to the longline fishery; Activity #1.4); o Purse seine fisheries with observer coverage in three Pacific Island countries (for Activities #1.1–iv thru v, which are relevant to the purse seine fishery; Activity #1.3). iii. Initial informal discussions have occurred with the relevant CCMs, but formal arrangements have yet to be established. iv. The selection and testing of suitable equipment (e.g. motion compensating scales, where required) has yet to be undertaken. v. Anticipate expanding the collection of conversion factor data, once a review of any issues/constraints with the initial data collection has been done (late 2020). vi. Pursue the potential for EM to obtain conversion factor (as per Activity #2.1).

ANNEX 3 – Examples of work and outputs produced for Project 90 as at July 2019

Table 2. Provisional Length:Length and Weight:Weight Conversion Factor data (Refer to ANNEX 4 for measurement codes; data entry and quality control ongoing)

Species	Convert from	Convert to	Main	Formula	Sex	Sample information		Source	Comments
						N	R squared		
ALB	GG	WW	Y	WW = 1.1 x (GG)		0	0	Processed catch from the Hawaii longline fishery	
ALB	GH	WW	Y	WW = 1.16 x (GH)		0	0	Processed catch from the Hawaii longline fishery	
ALB	GO	WW	Y	WW = 1.06 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
ALB	GX	WW	Y	WW = 1.18 x (GX)		0	0	Processed catch from the Hawaii longline fishery	
ALV	TL	UF	Y	UF = 0.533 x (TL) - 1.2007		0	0	S.KOHIN (PERS.COMM)	
ALV	TL	UF	A	UF = 0.5474 x (TL) + 7.0262		0	0	KOHLER ET AL 1995 (NW ATL)	
BET	GG	WW	Y	WW = 1.275 x (GG + RAND-0.5)^0.968		0	0	Langley et al. (2006)	
BET	GG	WW	A	WW = 1.1782 x (GG)		3323	0.9886	Observer conversion factor data (N=3323)	
BET	GG	WW	A	WW = 1.16 x (GG)		0	0	Processed catch from the Hawaii longline fishery	
BET	GH	WW	Y	WW = 1.25 x (GH)		0	0	Processed catch from the Hawaii longline fishery	
BET	GO	WW	Y	WW = 1.06 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
BET	GT	WW	Y	WW = 1.3264 x (GT + RAND-0.5)^0.969		0	0	Langley et al. (2006)	
BET	GX	WW	Y	WW = 1.25 x (GX)		0	0	Processed catch from the Hawaii longline fishery	
BLM	EO	LF	Y	LF = 1.1111 x (EO)		0	0		
BLM	GG	WW	Y	WW = 1.2 x (GG)		19	0.7357	Observer conversion factor data (N=19)	
BLM	GG	WW	A	WW = 1.2 x (GG)		0	0	Processed catch from the Hawaii longline fishery	
BLM	GH	WW	Y	WW = 1.433 x (GH)		0	0	Processed catch from the Hawaii longline fishery	
BLM	GO	WW	Y	WW = 1.15 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
BLM	GX	WW	Y	WW = 1.45 x (GX)		0	0	Processed catch from the Hawaii longline fishery	
BLM	PF	LF	Y	LF = 1.29032 x (PF)		0	0	SPC conversion factor data	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information		Source	Comments
						N	R squared		
BSH	FN	WW	Y	WW = 20 x (FN)		0	0		
BSH	SL	UF	Y	UF = 1.092 x (SL) + 0.745		12657	0	FRANCIS & DUFFY 2005	SOUTH PACIFIC
BSH	TL	SL	Y	SL = 0.762 x (TL) - 2.505		267	0.999	NAKANO & SEKI 2003	
BSH	TL	UF	Y	UF = 0.829 x (TL) - 1.122		0	0	NOAA SWFSC (unpublished data)	NORTH PACIFIC
BSH	TL	UF	Y	UF = 0.838 x (TL) - 1.615		273	0	FRANCIS & DUFFY 2005	SOUTH PACIFIC
BSH	TL	UF	Y	UF = 0.8313 x (TL) + 1.39		0	0	KOHLER ET AL 1995	
BSH	UF	SL	Y	SL = 0.9075 x (UF) + 0.3956		0	0	KOHLER ET AL 1995	
BTH	SL	TL	Y	TL = 1.75 x (SL) - 4.96	F	0	0	WHITE 2007 (INDIAN OCEAN)	
BTH	SL	TL	Y	TL = 1.7 x (SL) + 192.31	M	0	0	WHITE 2007 (INDIAN OCEAN)	
BTH	SL	TL	Y	TL = 1.81 x (SL) + 15.3	F	0	0	LIU ET AL 1998	
BTH	SL	TL	Y	TL = 1.76 x (SL) + 15.1	M	0	0	LIU ET AL 1998	
BTH	TL	UF	Y	UF = 0.5598 x (TL) + 17.666	M	0	0	KOHLER ET AL 1995 (NW ATL)	
BTH	UF	TL	Y	TL = 1.62 x (UF) + 164.74	M	0	0	WHITE 2007 (INDIAN OCEAN)	
BTH	UF	TL	Y	TL = 1.56 x (UF) + 26.3		0	0		
BTH	UF	TL	Y	TL = 1.75 x (UF) - 3.2	F	0	0	WHITE 2007 (INDIAN OCEAN)	
BTH	UF	TL	Y	TL = 1.69 x (UF) + 13.3	F	0	0	LIU ET AT 1998	
BUM	EO	LF	Y	LF = 1.1111 x (EO)		0	0		
BUM	GG	WW	Y	WW = 1.2605 x (GG)		103	0.9855	Observer conversion factor data (N=103)	
BUM	GG	WW	A	WW = 1.25 x (GG)		0	0	Processed catch from the Hawaii longline fishery	
BUM	GH	WW	Y	WW = 1.47 x (GH)		0	0	Processed catch from the Hawaii longline fishery	
BUM	GO	WW	Y	WW = 1.15 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
BUM	GX	WW	Y	WW = 1.54 x (GX)		0	0	Processed catch from the Hawaii longline fishery	
BUM	PF	LF	Y	LF = 1.22714 x (PF)		0	0	SPC conversion factor data	
DOL	GG	WW	A	WW = 1.11 x (GG)		0	0		
DOL	GH	WW	A	WW = 1.54 x (GH)		0	0		
DOL	GO	WW	A	WW = 1.06 x (GO)		0	0		
DOL	GX	WW	A	WW = 1.56 x (GX)		0	0		
EUB	UF	TL	Y	TL = 1.31 x (UF) + 3.1		0	0	Stevens & Lyle 1989	
FAL	FN	WW	Y	WW = 20 x (FN)		0	0		
FAL	SL	TL	Y	TL = 1.32 x (SL) + 2.08		84	0.99	OSHITANI ET AL 2003	RANGE SIZE = 48-148CM
FAL	SL	TL	Y	TL = 1.31 x (SL) + 3.64		469	0.98	JOUNG ET AL 2008	
FAL	SL	UF	Y	UF = 1.09 x (SL) + 1.1		469	0.99	JOUNG ET AL 2008	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information		Source	Comments
						N	R squared		
FAL	SL	UF	Y	UF = 1.03 x (SL) + 1.09		362	0.98	OSHITANI ET AL 2003	RANGE SIZE = 48-184CM
FAL	UF	TL	Y	TL = 1.21 x (UF) + 2.36		469	0.98	JOUNG ET AL 2008	
MAK	FN	WW	Y	WW = 20 x (FN)		0	0		
MLS	GG	WW	Y	WW = 1.17884 x (GG + RAND-0.5)^0.9984		0	0	Langley et al. (2006)	
MLS	GG	WW	A	WW = 1.23 x (GG)		0	0	Processed catch from the Hawaii longline fishery	
MLS	GG	WW	A	WW = 1.2314 x (GG)		21	0.9378	Observer conversion factor data	
MLS	GH	WW	Y	WW = 1.37 x (GH)		0	0	Processed catch from the Hawaii longline fishery	
MLS	GO	WW	Y	WW = 1.15 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
MLS	GX	WW	Y	WW = 1.11 x (GX)		0	0		
MLS	LF	EO	Y	EO = 0.862069 x (LF)		0	0	SPC conversion factor data	
MLS	PF	LF	Y	LF = 1.17946 x (PF)		0	0	SPC conversion factor data	
OCS	FN	WW	Y	WW = 20 x (FN)		0	0		
OCS	SL	TL	Y	TL = 1.397 x (SL)		0	0	SEKI ET AL 1998 (ESTIMATED FROM BASS ET AL 1973)	
OCS	UF	TL	Y	TL = 1.13477 x (UF) + 12.5374		0	0	ICCAT 2014	
PBF	GG	WW	A	WW = 1.18 x (GG)		0	0		
PBF	GH	WW	A	WW = 1.41 x (GH)		0	0		
PBF	GO	WW	A	WW = 1.09 x (GO)		0	0		
PBF	GX	WW	A	WW = 1.52 x (GX)		0	0		
POR	TL	UF	Y	UF = 0.89 x (TL) + 0.3369		6038	0	Francis 2013	
PTH	SL	TL	Y	TL = 2.05 x (SL) + 101.71	M	0	0	WHITE 2007	
PTH	SL	TL	Y	TL = 1.93 x (SL) + 2.34	F	0	0	LIU ET AL 1999	
PTH	SL	TL	Y	TL = 1.89 x (SL) + 2.33	M	0	0	LIU ET AL 1999	
PTH	SL	TL	Y	TL = 1.7362 x (SL) + 18.044	M	0	0	ROMERO-CAICEDO 2014	
PTH	SL	TL	Y	TL = 1.98 x (SL) + 195.58	F	0	0	WHITE 2007	
PTH	UF	TL	Y	TL = 1.85 x (UF) + 123.12	M	0	0	WHITE 2007	
PTH	UF	TL	Y	TL = 1.72 x (UF) + 333.359	F	0	0	WHITE 2007	
RHN	SL	TL	Y	TL = 1.2182 x (SL) + 33.036		41	0	WINTNER 2000 AND ROHNER ET AL 2011 IN ROHNER ET AL 2015	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information		Source	Comments
						N	R squared		
RHN	SL	TL	Y	TL = 1.252 x (SL) + 20.308		21	0.986	WINTNER 2000 (COMBINING DATA WITH BECKLEY ET AL 1997 FOR ADULTS RELATIONSHIPS AND DATA FROM BASS ET AL 1975, WOLFSON 1983 AND CHANG ET AL 1997 FOR THE EMBRYOS RELATIONSHIP)	
RHN	SL	UF	Y	UF = 1.106 x (SL) + 7.919		7	0.996	WINTNER 2000 (COMBINING DATA WITH BECKLEY ET AL 1997 FOR ADULTS RELATIONSHIPS AND DATA FROM BASS ET AL 1975, WOLFSON 1983 AND CHANG ET AL 1997 FOR THE EMBRYOS RELATIONSHIP)	
RHN	UF	TL	Y	TL = 1.063 x (UF) + 26.491		8	0.975	WINTNER 2000 (COMBINING DATA WITH BECKLEY ET AL 1997 FOR ADULTS RELATIONSHIPS AND DATA FROM BASS ET AL 1975, WOLFSON 1983 AND CHANG ET AL 1997 FOR THE EMBRYOS RELATIONSHIP)	
SFA	GG	WW	A	WW = 1.12 x (GG)		0	0		
SFA	GH	WW	A	WW = 1.52 x (GH)		0	0		
SFA	GO	WW	A	WW = 1.08 x (GO)		0	0		
SFA	GX	WW	A	WW = 1.56 x (GX)		0	0		
SKJ	GG	WW	Y	WW = 1.14 x (GG)		0	0		
SKJ	GH	WW	Y	WW = 1.33 x (GH)		0	0	Processed catch from the Hawaii longline fishery	
SKJ	GO	WW	Y	WW = 1.09 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
SKJ	GX	WW	Y	WW = 1.35 x (GX)		0	0	Processed catch from the Hawaii longline fishery	
SMA	SL	UF	Y	UF = 1.1 x (SL) + 0.766		999	0	KOHLER ET AL 1995	RANGE = 61-346
SMA	TL	SL	Y	SL = 0.816 x (TL) + 0.784		1240	0	JOUNG & HSU 2005	RANGE = 80-375 NORTH PACIFIC
SMA	TL	SL	Y	SL = 0.84 x (TL) - 2.13		131	0	SEMBA ET AL.2009 NORTH PACIFIC	
SMA	TL	UF	Y	UF = 0.89 x (TL) + 0.952		1236	0	JOUNG & HSU 2005	RANGE = 80-375 NORTH PACIFIC
SMA	TL	UF	Y	UF = 0.913 x (TL) - 0.397		2177	0	WELLS ET AL 2013 NORTH PACIFIC	
SMA	TL	UF	Y	UF = 0.911 x (TL) + 0.821		399	0		RANGE = 70-346CM FL

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
SMA	TL	UF	Y	UF = 0.905 x (TL) + 1.345	F	5542	0	CERNA & LICANDEO 2009	RANGE = 75-330CM TL
SMA	TL	UF	Y	UF = 0.894 x (TL) + 2.912	M	5149	0	CERNA & LICANDEO 2009	RANGE = 76-285CM TL
SMA	TL	UF	Y	UF = 0.9286 x (TL) - 1.7101		0	0	KOHLER ET AL 1995	
SMA	UF	SL	Y	SL = 0.91 x (UF) - 0.95		130	0	SEMBA ET AL 2009	RANGES 57-187 BOTH SEXES NORTH PACIFIC
SPK	SL	TL	Y	TL = 1.39 x (SL) + 74.19		46	0		
SPK	UF	TL	Y	TL = 1.2533 x (UF) + 3.472		216	0	PIERCY ET AL 2010	
SPK	UF	TL	Y	TL = 1.29 x (UF) + 3.58		261	0	STEVENS & LYLE 1989	
SPK	UF	TL	Y	TL = 1.29 x (UF) + 49.01		46	0	HARRY ET AL 2011	
SPL	UF	TL	Y	TL = 1.296 x (UF) + 0.516		0	0	PIERCY ET AL 2007	
SPL	UF	TL	Y	TL = 1.3 x (UF) + 15.38		0	0	HARRY ET AL 2011	
SPN	FN	WW	Y	WW = 20 x (FN)		0	0		
SPZ	TL	UF	Y	UF = 0.84 x (TL) + 12.72		0	0	COELHO ET AL 2011	
SSP	GG	WW	A	WW = 1.11 x (GG)		0	0		
SSP	GH	WW	A	WW = 1.32 x (GH)		0	0		
SSP	GO	WW	A	WW = 1.05 x (GO)		0	0		
SSP	GX	WW	A	WW = 1.33 x (GX)		0	0		
SWO	EO	LF	Y	LF = 1.1111 x (EO)		0	0		
SWO	FW	WW	Y	WW = 1.5269 x (FW)		0	0	Observer conversion factor data (N=683)	
SWO	GG	WW	Y	WW = 1.3717 x (GG + RAND-0.5)		0	0	Langley et al. (2006)	
SWO	GG	WW	A	WW = 1.14 x (GG)		0	0	Processed catch from the Hawaii longline fishery	
SWO	GG	WW	A	WW = 1.2551 x (GG)		10	0.9834	Observer conversion factor data	
SWO	GH	WW	Y	WW = 1.39 x (GH)		0	0	Processed catch from the Hawaii longline fishery	
SWO	GO	WW	Y	WW = 1.09 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
SWO	GX	WW	Y	WW = 1.45 x (GX)		0	0	Processed catch from the Hawaii longline fishery	
SWO	PF	LF	Y	LF = 1.31579 x (PF)		0	0	SPC conversion factor data	
WAH	GG	WW	A	WW = 1.1 x (GG)		0	0		
WAH	GH	WW	A	WW = 1.22 x (GH)		0	0		
WAH	GO	WW	A	WW = 1.15 x (GO)		0	0		

Species	Convert from	Convert to	Main	Formula	Sex	Sample information		Source	Comments
						N	R squared		
WAH	GX	WW	A	WW = 1.23 x (GX)		0	0		
YFT	GG	WW	Y	WW = 1.1893 x (GG + RAND-0.5)^0.972		0	0	Langley et al. (2006). The use of "rand" is explained in this reference.	
YFT	GG	WW	A	WW = 1.12 x (GG)		0	0	Processed catch from the Hawaii longline fishery	
YFT	GG	WW	A	WW = 1.1561 x (GG)		9596	0.9863	Observer conversion factor data	
YFT	GH	WW	Y	WW = 1.22 x (GH)		0	0	Processed catch from the Hawai longline fishery	
YFT	GO	WW	Y	WW = 1.06 x (GO)		0	0	Processed catch from the Hawaii longline fishery	
YFT	GT	WW	Y	WW = 1.2988 x (GT + RAND-0.5)^0.968		0	0	Langley et al. (2006)	
YFT	GX	WW	Y	WW = 1.23 x (GX)		0	0	Processed catch from the Hawaii longline fishery	

Table 3. Provisional Length:Weight Conversion Factor data (Refer to ANNEX 4 for measurement codes; data entry and quality control ongoing)

Species	Convert from	Convert to	Main	Formula	Sex	Sample information		Source	Comments
						N	R squared		
ABU	UF	WW	A	WW = 1.64e-005 x (UF)^3.142		35	0	Bohnsack, J.A. and D.E. Harper,1988,Length-weight relationships of selected marine reef fishes from the southeastern United States and the Caribbean.	
AGS	UF	WW	A	WW = 0.000118 x (UF)^2.075		0	0	Pauly, D., A. Cabanban and F.S. B. Torres, Jr.,1996,Fishery biology of 40 trawl-caught teleosts of western Indonesia.	
ALB	UF	WW	Y	WW = 1.43e-005 x (UF)^3.1		0	0	WILLIAMS ET AL, 2012	
ALB	UF	WW	A	WW = 2.97125e-005 x (UF)^2.90141		8891	0.889	Observer conversion factor data	
ALM	UF	WW	A	WW = 1.94e-005 x (UF)^2.96		96	0	, 0,	
ALN	UF	WW	A	WW = 2.19e-006 x (UF)^3		71	0	Bohnsack, J.A. and D.E. Harper,1988,Length-weight relationships of selected marine reef fishes from the southeastern United States and the Caribbean.	
ALS	SL	WW	A	WW = 3.04e-006 x (SL)^3.243		0	0	Kulbicki, M., G. Mou Tham, P. Thollot and L. Wantiez,1993,Length-weight relationships of fish from the lagoon of New Caledonia.	
ALV	TL	WW	A	WW = 0.0001879 x (TL)^2.519	0	0	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
ALV	UF	WW	Y	WW = 0.00018821 x (UF)^2.5188		0	0	KOHLER ET AL 1995 (NW ATL)	
AMB	UF	WW	A	WW = 5.029e-005 x (UF)^2.809		30	0	Bohnsack, J.A. and D.E. Harper,1988,Length-weight relationships of selected marine reef fishes from the southeastern United States and the Caribbean.	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information		Source	Comments
						N	R squared		
AML	TL	WW	A	WW = 8.77e-006 x (TL)^3.05		54	0	Letourneur, Y., M. Kulbicki, and P. Labrosse,1998,Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update.	
ASA	UF	WW	A	WW = 3.5e-006 x (UF)^2.79		0	0	Annala, J.H. (comp.),1994,Report from the Fishery Assessment Plenary, May 1994: stock assessments and yield estimates.	
AVR	UF	WW	A	WW = 2.549e-005 x (UF)^2.87		77	0	Letourneur, Y., M. Kulbicki, and P. Labrosse,1998,Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update.	
BAC	UF	WW	A	WW = 2.49e-006 x (UF)^3.245		0	0	Kulbicki, M., G. Mou Tham, P. Thollot and L. Wantiez,1993,Length-weight relationships of fish from the lagoon of New Caledonia.	
BAR	UF	WW	A	WW = 0.0005 x (UF)^2.062		0	0	Speces Platax orbicularis used	
BAT	UF	WW	A	WW = 4.25e-005 x (UF)^2.975		0	0		
BET	UF	WW	Y	WW = 3.195e-005 x (UF)^2.9113		0	0	CAMPBELL 2011	
BET	UF	WW	A	WW = 2.34684e-005 x (UF)^2.97575		802	0.9343	Regional Observer data	
BIS	UF	WW	A	WW = 4e-006 x (UF)^3.259		1104	0	Letourneur, Y.,2000,First length-weight relationships of some marine fish species of R,union Island, SW Indian Ocean.	
BLM	LF	WW	A	WW = 6.614e-005 x (LF)^2.61109		19	0.742	Regional Observer data	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
BLM	PF	WW	A	WW = 6.6e-006 x (PF)^3.361		0	0	Age and Growth of Black Marlin, Makaira indica, in East coast Australian waters, Peter Speare and David McB Williams (unpublished). N=108; male and female; east Australia.	
BLT	UF	WW	A	WW = 1.004e-005 x (UF)^3.13		744	0	Uchida, R.N.,1981,Synopsis of biological data on frigate tuna, @Auxis thazard@, and bullet tuna, @A. rochei@.	
BOX	UF	WW	A	WW = 3.7e-007 x (UF)^3.27		0	0	Formula for Aphanopus carbo used	
BRO	TL	WW	A	WW = 1.04e-005 x (TL)^2.9		0	0	Torres, F.S.B., Jr.,1991,Tabular data on marine fishes from Southern Africa, Part I. Length-weight relationships.	
BSH	FL	WW	A	WW = 3.17e-006 x (FL)^3.131		4529	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
BSH	SL	WW	Y	WW = 2.3279e-006 x (SL)^3.294	F	148	0.994	NAKANO ET AL 1985	
BSH	SL	WW	Y	WW = 3.293e-006 x (SL)^3.225	M	2910	0.993	NAKANO 1994	
BSH	SL	WW	Y	WW = 5.388e-006 x (SL)^3.102	F	2890	0.992	NAKANO 1994	
BSH	TL	WW	Y	WW = 5.009e-006 x (TL)^3.054		0	0	NOPA SWFSC (UNPUB DATA)	
BSH	TL	WW	Y	WW = 2.57e-005 x (TL)^3.05		150	0.849	HARVEY 1989	
BSH	TL	WW	Y	WW = 3.838e-006 x (TL)^3.174	M	285	0.997	NAKANO ET AL 1985	
BSH	UF	WW	Y	WW = 1e-006 x (UF)^3.23		44	0.91	JOUNG ET AL 2011	
BSH	UF	WW	Y	WW = 1.57761e-006 x (UF)^3.282	M	1666	0.942	AYERS ET AL 2004	
BSH	UF	WW	Y	WW = 6.36796e-007 x (UF)^3.485	F	3053	0.948	AYERS ET AL 2004	
BSK	TL	WW	A	WW = 4.93e-006 x (TL)^3		2	0	, 0,	
BTH	SL	WW	Y	WW = 6.87e-005 x (SL)^2.769	F	0	0	LIU ET AL 1998	
BTH	SL	WW	Y	WW = 9.93e-005 x (SL)^2.685	M	0	0	LIU ET AL 1998	
BTH	TL	WW	Y	WW = 3.73e-005 x (TL)^2.57	M	0	0	LIU ET AL 1998	
BTH	TL	WW	Y	WW = 9.1069e-006 x (TL)^3.0802	M	0	0	KOHLER ET AL 1995 (NS ATL)	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
BTH	TL	WW	Y	WW = 1.02e-005 x (TL)^2.78	F	0	0	LIU ET AL 1998	
BUM	LF	WW	A	WW = 4.221e-005 x (LF)^2.71359		103	0.781	Regional Observer data	
BWA	UF	WW	A	WW = 1.499e-005 x (UF)^3.041		78	0	, 0,	
CCL	TL	WW	A	WW = 7.13e-006 x (TL)^3.01		0	0	Torres, F.S.B., Jr.,1991,Tabular data on marine fishes from Southern Africa, Part I. Length-weight relationships.	
CCP	FL	WW	A	WW = 1.09e-005 x (FL)^3.012		1548	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
CEO	UF	WW	A	WW = 2.4e-006 x (UF)^3.346		33	0	Coull, K.A., A.S. Jermyn, A.W. Newton, G.I. Henderson and W.B. Hall,1989,Length/weight relationships for 88 species of fish encountered in the North Atlantic.	
CNT	UF	WW	A	WW = 5.979e-005 x (UF)^2.817		0	0	Formula for Canthidermis sufflamen used	
COM	UF	WW	A	WW = 1.059e-005 x (UF)^2.94		0	0	Torres, F.S.B., Jr.,1991,Tabular data on marine fishes from Southern Africa, Part I. Length-weight relationships.	
CRF	UF	WW	A	WW = 4.14e-005 x (UF)^2.85		47	0	Schroeder, R.E.,1982,Length-weight relationships of fishes from Honda Bay, Palawan, Philippines.	
CXR	UF	WW	A	WW = 6.459e-005 x (UF)^2.748		98	0	Bohnsack, J.A. and D.E. Harper,1988,Length-weight relationships of selected marine reef fishes from the southeastern United States and the Caribbean.	
CXS	UF	WW	A	WW = 3.18e-005 x (UF)^2.93		24	0	Schroeder, R.E.,1982,Length-weight relationships of fishes from Honda Bay, Palawan, Philippines.	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
DGX	TL	WW	A	WW = 3.95e-006 x (TL)^3.004		279	0	, 0,	
DOL	UF	WW	A	WW = 1.899e-005 x (UF)^2.688		9799	0	Palko, B.J., G.L. Beardsley and W. Richards,1982,Synopsis of the biological data on dolphin-fishes, @Coryphaena hippurus@ Linnaeus and @Coryphaena equiselis@ Linnaeus.	
DUS	FL	WW	A	WW = 3.24e-005 x (FL)^2.786		247	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
ETA	UF	WW	A	WW = 2.16e-005 x (UF)^2.95		1814	0	Brouard, F. and R. Grandperrin,1984,Les poissons profonds de la pente r,cifale externe … Vanuatu.	
ETC	UF	WW	A	WW = 4.109e-005 x (UF)^2.758		1283	0	Pakoa, K.,1998,The biology of fishes of Vanuatu.	
EUB	TL	WW	Y	WW = 2.71e-006 x (TL)^3.56		0	0	Stevens & Lyle 1989	
FAL	FL	WW	A	WW = 1.539e-005 x (FL)^2.9225		85	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
FAL	TL	WW	Y	WW = 2.92e-006 x (TL)^3.15		469	0	JOUNG ET AL 2008	p<0.01
FIP	UF	WW	A	WW = 3e-007 x (UF)^3.158		43	0	Letourneur, Y., M. Kulbicki, and P. Labrosse,1998,Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update.	
FIT	UF	WW	A	WW = 3e-007 x (UF)^3.158		0	0	Species Fisturaria petimba used	
FLF	UF	WW	A	WW = 4.06e-005 x (UF)^2.792		0	0	Species Cantherhinus dumerili used	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	Sample information R squared	Source	Comments
FRI	UF	WW	A	WW = 1.79e-006 x (UF)^3.334		160	0	Uchida, R.N.,1981,Synopsis of biological data on frigate tuna, @Auxis thazard@, and bullet tuna, @A. rochei@.	
GAG	FL	WW	A	WW = 1.81e-005 x (FL)^2.72		0	0	Annala, J.H. (comp.),1994,Report from the Fishery Assessment Plenary, May 1994: stock assessments and yield estimates.	
GBA	UF	WW	A	WW = 4.11e-006 x (UF)^3.083		10	0	Bohnsack, J.A. and D.E. Harper,1988,Length-weight relationships of selected marine reef fishes from the southeastern United States and the Caribbean.	
GEM	UF	WW	A	WW = 3.4e-006 x (UF)^3.22		0	0	Annala, J.H. (comp.),1994,Report from the Fishery Assessment Plenary, May 1994: stock assessments and yield estimates.	
GLT	UF	WW	A	WW = 3.9e-005 x (UF)^2.84		69	0	Schroeder, R.E.,1982,Length-weight relationships of fishes from Honda Bay, Palawan, Philippines.	
GRN	UF	WW	A	WW = 6e-006 x (UF)^2.85		0	0	Annala, J.H. (comp.),1994,Report from the Fishery Assessment Plenary, May 1994: stock assessments and yield estimates.	
HER	UF	WW	A	WW = 4.97e-006 x (UF)^3.192		0	0	Coull, K.A., A.S. Jermyn, A.W. Newton, G.I. Henderson and W.B. Hall,1989,Length/weight relationships for 88 species of fish encountered in the North Atlantic.	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
KAW	UF	WW	A	WW = 2.999e-005 x (UF)^2.908		0	0	van der Elst, R.P. and F. Adkin (eds.),1991,Marine linefish: priority species and research objectives in southern Africa.	
LOB	UF	WW	A	WW = 4.28e-005 x (UF)^2.84		0	0	Torres, F.S.B., Jr.,1991,Tabular data on marine fishes from Southern Africa, Part I. Length-weight relationships.	
MAC	UF	WW	A	WW = 3.8e-006 x (UF)^3.21		0	0	Coull, K.A., A.S. Jermyn, A.W. Newton, G.I. Henderson and W.B. Hall,1989,Length/weight relationships for 88 species of fish encountered in the North Atlantic.	
MAK	TL	WW	A	WW = 1.2e-006 x (TL)^3.46		0	0		
MAS	UF	WW	A	WW = 3.46e-006 x (UF)^3.227		216	0	Gon‡alves, J.M.S., L. Bentes, P.G. Lino, J. Ribeiro, A.V.M. Can rio and K. Erzini,1997,Weight-length relationships for selected fish species of the small-scale demersal fisheries of the south and sout	
MIL	UF	WW	A	WW = 7.3e-006 x (UF)^3.251		96	0	Letourneur, Y., M. Kulbicki, and P. Labrosse,1998,Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update.	
MLS	LF	WW	A	WW = 0.0022 x (LF)^1.9555		12	0.5876	Regional Observer data	
MLS	UF	WW	Y	WW = 1.012e-008 x (UF)^3.55		0	0	KOPF ET AL 2011 lenwt_a = 0.00000001012 to be fixed	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	Sample information R squared	Source	Comments
MOX	UF	WW	A	WW = 4.54e-005 x (UF)^3.05		13	0	Coull, K.A., A.S. Jermyn, A.W. Newton, G.I. Henderson and W.B. Hall,1989,Length/weight relationships for 88 species of fish encountered in the North Atlantic.	
OCS	FL	WW	A	WW = 1.7e-005 x (FL)^2.98		32	0	Claro, R. and J.P. Garc¡a-Arteaga,1994,Crecimiento.	
OCS	SL	WW	Y	WW = 5.076e-005 x (SL)^2.761	F	128	0	SEKI ET AL 1998	
OCS	SL	WW	Y	WW = 3.0778e-005 x (SL)^2.86	M	0	0	SEKI ET AL 1998 (N=133)	
OCS	TL	WW	Y	WW = 1.66e-005 x (TL)^2.819		188	0	CHEN 2006 IN LIU & TSAI 2011	
OCS	TL	WW	Y	WW = 1.405e-007 x (TL)^3.72		17	0	STEVENS 1984	
ORY	UF	WW	A	WW = 3.299e-005 x (UF)^3.003		0	0	, 0,	
PIL	UF	WW	A	WW = 5.94e-006 x (UF)^3.077		2913	0	Dorel, D.,1985,Poissons de l'Atlantique nord-est relations taille-poids.	
POA	UF	WW	A	WW = 1.09e-006 x (UF)^3.609		0	0		
POR	TL	WW	A	WW = 1.48e-005 x (TL)^2.964		15	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
POR	UF	WW	Y	WW = 2.14891e-005 x (UF)^2.924		2457	0	AYERS ET AL 2004	MOST DATA FROM JUVENILS <150 CM FL
PTH	SL	WW	Y	WW = 0.000225 x (SL)^2.533		0	0	LIU ET AL 2006	
PTH	SL	WW	Y	WW = 0.000159 x (SL)^2.613	F	0	0	LIU ET AL 1999	
PTH	SL	WW	Y	WW = 0.000196 x (SL)^2.562	M	0	0	LIU ET AL 1999	
PTH	TL	WW	Y	WW = 3.98e-005 x (TL)^2.52	M	0	0	LIU ET AL 1999	
PTH	TL	WW	Y	WW = 4.61e-005 x (TL)^2.494	F	0	0	LIU ET AL 1999	
PTH	TL	WW	Y	WW = 4e-007 x (TL)^3.217		0	0	WHITE 2007	
RIB	UF	WW	A	WW = 2.4e-006 x (UF)^3.37		113	0	, 0,	
RRU	UF	WW	A	WW = 1.35e-005 x (UF)^2.92		0	0	Kulbicki, M., G. Mou Tham, P. Thollot and L. Wantiez,1993,Length-weight relationships of fish from the lagoon of New Caledonia.	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
RSA	UF	WW	A	WW = 1.19e-005 x (UF)^3		0	0	Federizon, R.,1993,Using vital statistics and survey catch composition data for tropical multispecies fish stock assessment: application to the demersal resources of the central Philippines.	
RSS	UF	WW	A	WW = 1.789e-005 x (UF)^2.973		0	0	van der Elst, R.P. and F. Adkin (eds.),1991,Marine linefish: priority species and research objectives in southern Africa.	
RUS	UF	WW	A	WW = 1.46e-005 x (UF)^2.948		16	0	Letourneur, Y., M. Kulbicki, and P. Labrosse,1998,Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update.	
SBF	UF	WW	A	WW = 2.649e-005 x (UF)^2.94		0	0	, 0,	
SFA	LF	WW	A	WW = 1.19e-006 x (LF)^3.2208		0	0	, 0,	
SFS	UF	WW	A	WW = 3e-007 x (UF)^3.19		40	0	, 0,	
SKJ	UF	WW	A	WW = 1.3033e-005 x (UF)^3.044		0	0	Determined by data collected by SPC	
SMA	TL	WW	Y	WW = 1.1e-005 x (TL)^2.95		612	0	JOUNG&HSU 2005	North Pacific
SMA	TL	WW	Y	WW = 2.8e-005 x (TL)^2.771	M	807	0	CHANG & LIU 2009 (CITES CHANG UNPUBLISHED - CHANG)	North Pacific
SMA	UF	WW	Y	WW = 5.243e-006 x (UF)^3.141		0	0	KOHLER ET AL 1995	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
SMA	UF	WW	Y	WW = 2.38781e-005 x (UF)^2.847		1016	0		SE PACIFIC FL vs TL REGRESSIONS (BY SEPARATE SEX) HAVE VERY LARGE SAMPLE SIZES. ALTHOUGH THEY HAVE NOT BEEN LISTED HERE THEY MAY BE APPLICABLE TO THE SW PACIFIC STOCK
SMA	UF	WW	Y	WW = 1.103e-005 x (UF)^3.009		0	0	NOAA SWFSC (UNPUB DATA)	North Pacific
SNK	UF	WW	A	WW = 1.169e-005 x (UF)^2.82		0	0	Annala, J.H. (comp.),1994,Report from the Fishery Assessment Plenary, May 1994: stock assessments and yield estimates.	
SPD	UF	WW	A	WW = 2.13e-006 x (UF)^3.287		0	0	Kulbicki, M., G. Mou Tham, P. Thollot and L. Wantiez,1993,Length-weight relationships of fish from the lagoon of New Caledonia.	
SPK	TL	WW	Y	WW = 1.23e-005 x (TL)^3.24		117	0		
SPL	TL	WW	Y	WW = 2.82e-006 x (TL)^3.129	F	0	0	CHEN ET AL 1990	
SPL	TL	WW	Y	WW = 1.35e-006 x (TL)^3.252	M	0	0	CHEN ET AL 1990	
SPL	TL	WW	Y	WW = 3.99e-005 x (TL)^3.03		0	0	STEVENS & LYLE 1989	
SPL	TL	WW	Y	WW = 2e-005 x (TL)^2.8	F	0	0	ANISLADO-TOLENTINO & ROBINSON-MENDOZA 2001	
SPL	TL	WW	Y	WW = 1.05e-005 x (TL)^2.87	M	0	0	ANISLADO-TOLENTINO & ROBINSON-MENDOZA 2001	
SPR	UF	WW	A	WW = 2.11e-006 x (UF)^3.475		0	0	Coull, K.A., A.S. Jermyn, A.W. Newton, G.I. Henderson and W.B. Hall,1989,Length/weight relationships for 88 species of fish encountered in the North Atlantic.	
SPZ	TL	WW	Y	WW = 5.27e-007 x (TL)^3.42		0	0	STEVENS 1984	

Species	Convert from	Convert to	Main	Formula	Sex	Sample information N	R squared	Source	Comments
SRH	UF	WW	A	WW = 9.49e-006 x (UF)^3		868	0	, 0,	
SSP	LF	WW	A	WW = 4.62e-006 x (LF)^3		0	0	, 0,	
SWO	LF	WW	Y	WW = 4.797e-008 x (LF)^3.1921		0	0	CAMPBELL 2011	LENGTH CODE : LJFL
SWO	LF	WW	A	WW = 5.47e-006 x (LF)^3.17439		1965	0.9395	Regional Observer data	
TIG	FL	WW	A	WW = 2.52e-006 x (FL)^3.26		187	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
TRB	TL	WW	A	WW = 1.44e-006 x (TL)^3.382		20	0	Letourneur, Y., M. Kulbicki, and P. Labrosse,1998,Length-weight relationships of fish from coral reefs and lagoons of New Caledonia, southwestern Pacific Ocean: an update.	
WAH	UF	WW	A	WW = 0.0008 x (UF)^1.9763		0	0		
WHA	UF	WW	A	WW = 2.419e-005 x (UF)^2.867		0	0	Annala, J.H. (comp.),1994,Report from the Fishery Assessment Plenary, May 1994: stock assessments and yield estimates.	
WSH	FL	WW	A	WW = 7.57e-006 x (FL)^3.085		125	0	Kohler, N.E., J.G. Casey and P.A. Turner,1995,Length-weight relationships for 13 species of sharks from the western North Atlantic.	
YFT	UF	WW	Y	WW = 1.167e-006 x (UF)^3.0806		0	0	CAMPBELL 2011	
YFT	UF	WW	A	WW = 1.908e-005 x (UF)^2.97762		329	0.9296	Regional Observer data	
YTC	UF	WW	A	WW = 6.39e-005 x (UF)^2.61		0	0	Torres, F.S.B., Jr.,1991,Tabular data on marine fishes from Southern Africa, Part I. Length-weight relationships.	
YTL	UF	WW	A	WW = 6.35e-006 x (UF)^3.17		88	0	Pakoa, K.,1998,The biology of fishes of Vanuatu.	

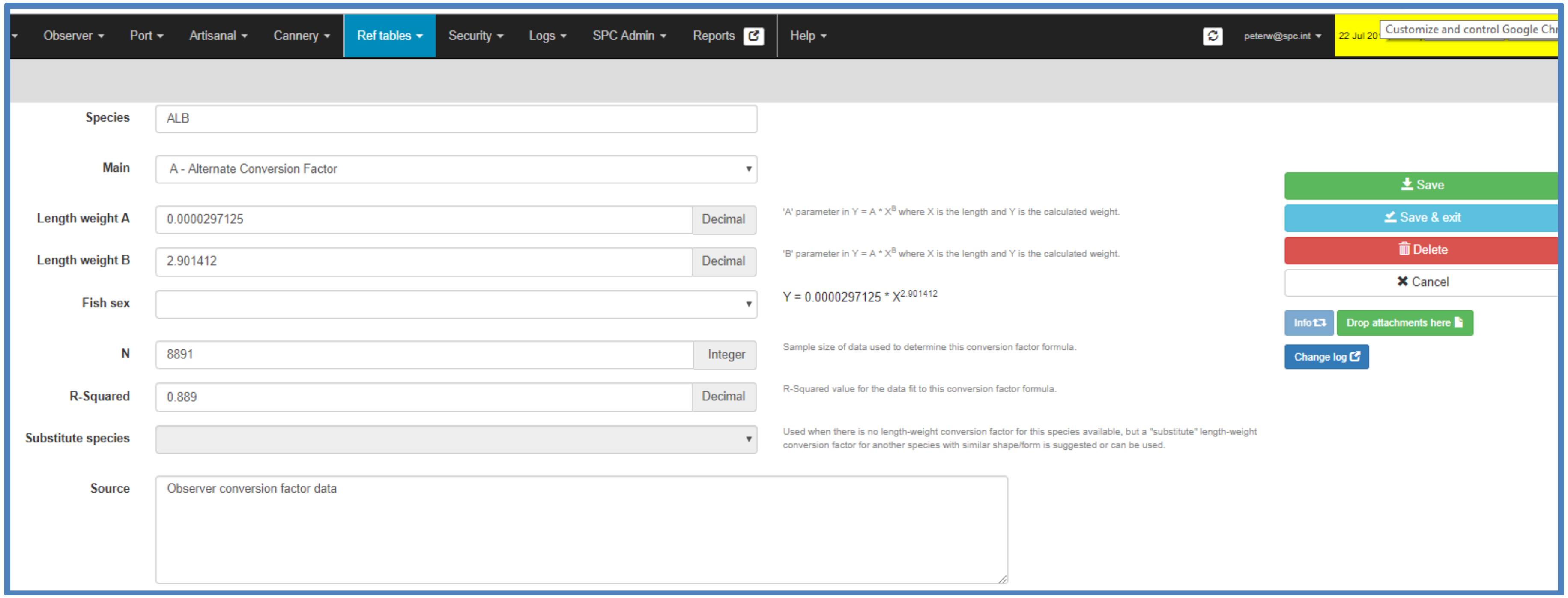
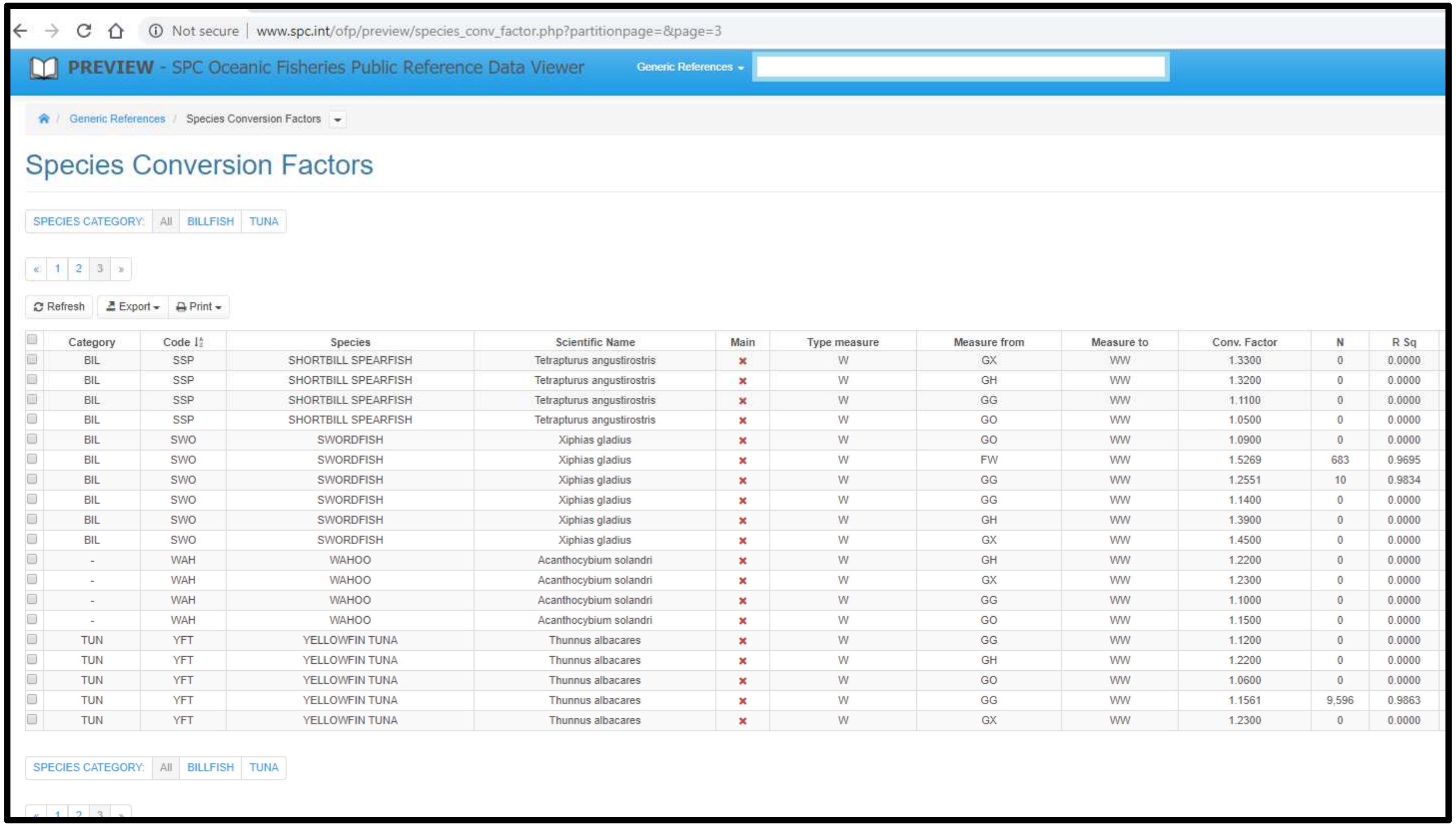


Figure 1. Example of the conversion factor (web-based) data entry screen



Not secure | www.spc.int/ofp/preview/species_conv_factor.php?partitionpage=&page=3

PREVIEW - SPC Oceanic Fisheries Public Reference Data Viewer

Generic References / Species Conversion Factors

Species Conversion Factors

SPECIES CATEGORY: All BILLFISH TUNA

« 1 2 3 »

Refresh Export Print

Category	Code	Species	Scientific Name	Main	Type measure	Measure from	Measure to	Conv. Factor	N	R Sq
BIL	SSP	SHORTBILL SPEARFISH	Tetrapturus angustirostris	×	W	GX	WW	1.3300	0	0.0000
BIL	SSP	SHORTBILL SPEARFISH	Tetrapturus angustirostris	×	W	GH	WW	1.3200	0	0.0000
BIL	SSP	SHORTBILL SPEARFISH	Tetrapturus angustirostris	×	W	GG	WW	1.1100	0	0.0000
BIL	SSP	SHORTBILL SPEARFISH	Tetrapturus angustirostris	×	W	GO	WW	1.0500	0	0.0000
BIL	SWO	SWORDFISH	Xiphias gladius	×	W	GO	WW	1.0900	0	0.0000
BIL	SWO	SWORDFISH	Xiphias gladius	×	W	FW	WW	1.5269	683	0.9695
BIL	SWO	SWORDFISH	Xiphias gladius	×	W	GG	WW	1.2551	10	0.9834
BIL	SWO	SWORDFISH	Xiphias gladius	×	W	GG	WW	1.1400	0	0.0000
BIL	SWO	SWORDFISH	Xiphias gladius	×	W	GH	WW	1.3900	0	0.0000
BIL	SWO	SWORDFISH	Xiphias gladius	×	W	GX	WW	1.4500	0	0.0000
-	WAH	WAHOO	Acanthocybium solandri	×	W	GH	WW	1.2200	0	0.0000
-	WAH	WAHOO	Acanthocybium solandri	×	W	GX	WW	1.2300	0	0.0000
-	WAH	WAHOO	Acanthocybium solandri	×	W	GG	WW	1.1000	0	0.0000
-	WAH	WAHOO	Acanthocybium solandri	×	W	GO	WW	1.1500	0	0.0000
TUN	YFT	YELLOWFIN TUNA	Thunnus albacares	×	W	GG	WW	1.1200	0	0.0000
TUN	YFT	YELLOWFIN TUNA	Thunnus albacares	×	W	GH	WW	1.2200	0	0.0000
TUN	YFT	YELLOWFIN TUNA	Thunnus albacares	×	W	GO	WW	1.0600	0	0.0000
TUN	YFT	YELLOWFIN TUNA	Thunnus albacares	×	W	GG	WW	1.1561	9,596	0.9863
TUN	YFT	YELLOWFIN TUNA	Thunnus albacares	×	W	GX	WW	1.2300	0	0.0000

SPECIES CATEGORY: All BILLFISH TUNA

Figure 2. Example of the prototype for disseminating conversion factor data (in the PREVIEW web-based tool)

ANNEX 4 – Codes used in the Conversation Factor data

Table 4.1 Measurement codes

Type	Code	Measurement Description
Length	AN	Anal fin length
	BL	Bill to fork in tail
	CC	Curved Carapace Length
	CK	Cleithrum to anterior base caudal keel
	CW	Carapace width
	CX	Cleithrum to caudal fork
	EO	Posterior eye orbital to caudal fork
	EV	Posterior eye orbital to vent
	FF	1st dorsal to fork in tail
	FS	1st dorsal to 2nd dorsal
	GI	Girth
	LF	lower jaw to fork in tail
	PC	Nose - anterior tail portion (sharks : caudal peduncle)
	PD	Snout (or nose) to anterior base of 1st dorsal (shark : pre first dorsal length)
	PF	Anterior base of pectoral fin to fork in tail
	PS	Anterior base of pectoral fin to 2nd dorsal
	SC	Straight Carapace Length
	SD	Upper jaw (or snout or nose) to anterior base of 2nd dorsal (shark : pre second dorsal length)
	SL	Tip of snout to (posterior) end of caudal peduncle (also referred to as precaudal pit)
	TH	Body Thickness (Width)
	TL	tip of snout to end of tail (shark: tip of snout to posterior end of dorsal caudal lobe in natural position)
	TW	total width (tip of wings - rays)
	UF	upper jaw to fork in tail (sharks : tip of snout to caudal fork)
	US	Upper jaw to 2nd dorsal fin (redundant with “SD”)
Weight	FN	Weight of all fins (sharks)
	FW	Fillets weight
	LW	Loin weight
	GF	Gilled, gutted, headed, flaps removed
	GG	Gilled and gutted weight
	GH	Gutted and headed weight
	GO	Gutted only (gills left in)
	GT	Gilled, gutted and tailed
	GX	Gutted, headed and tailed
	TT	Trunk weight
	WF	Whole weight (frozen)
	WW	Whole weight (fresh)

Table 4.2 Standard measurement units

LENGTH	CM	Centimetres	
WEIGHT	KG	Kilograms	KG = Pounds (lbs) x 0.453592