Camiñas 2015 Marine turtles and surface long line by-catch in Mediterranean Sea_Dalaman 5ª Mediterranean Sea Turtles Conference

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Filling the gaps for basin-integrated management
Dalaman (Turkey), 18-23 April 2015

Marine turtles and surface longline bycatch in the Mediterranean Sea

Lessons learned and remaining gaps for integrated regional management

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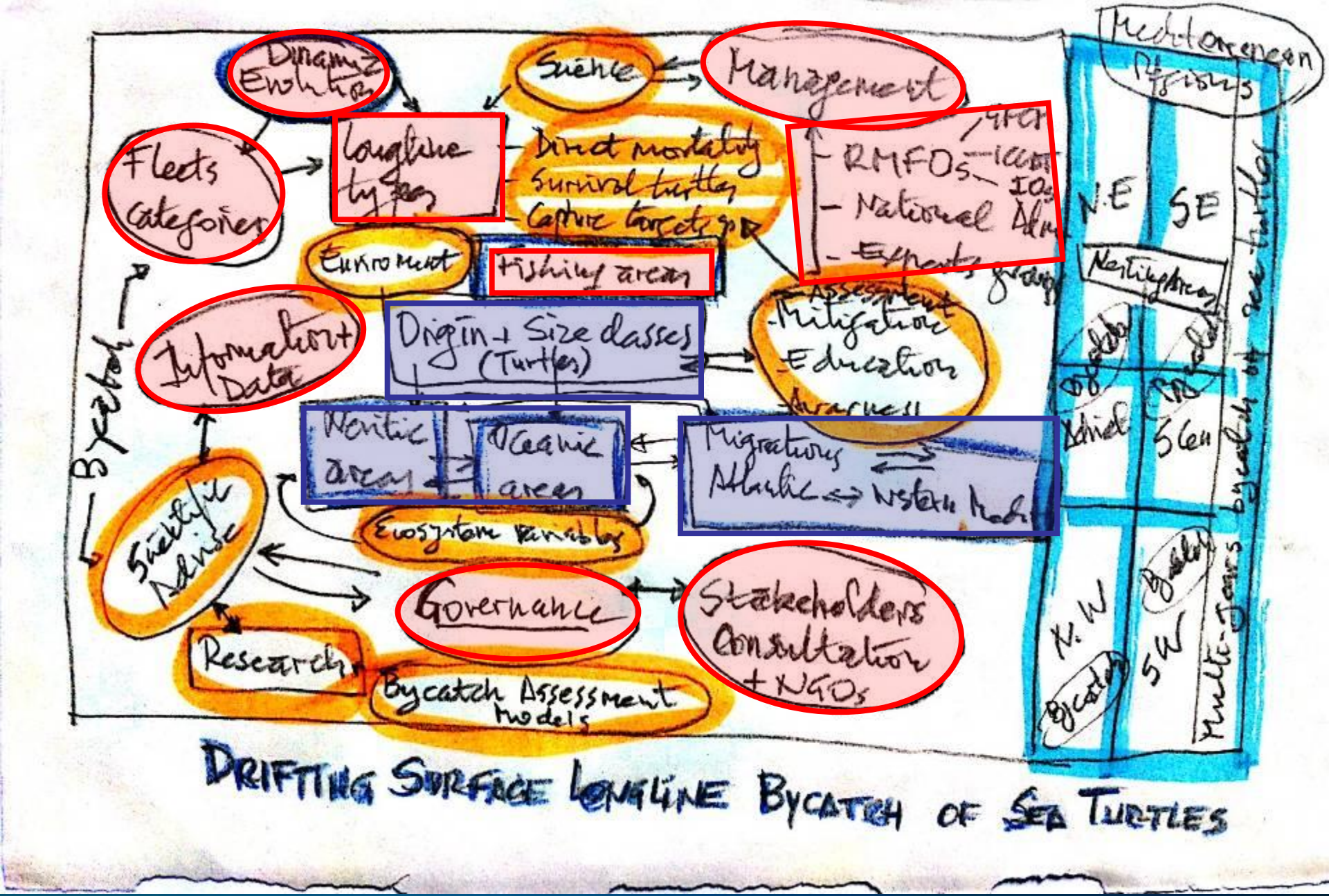
Science
Management
Fleets categories
Longline typology
Direct mortality
Survival turtles
Capture forces
RMFOs
National Adm
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Environment
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Information Data
Origin + Size classes (Turtles)
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DRIFTING SURFACE LONGLINE BYCATCH OF SEA TURTLES

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- Drifting Longline Fisheries bycatch of sea turtles, a global threat
- Mediterranean fisheries and Sea turtle bycatch
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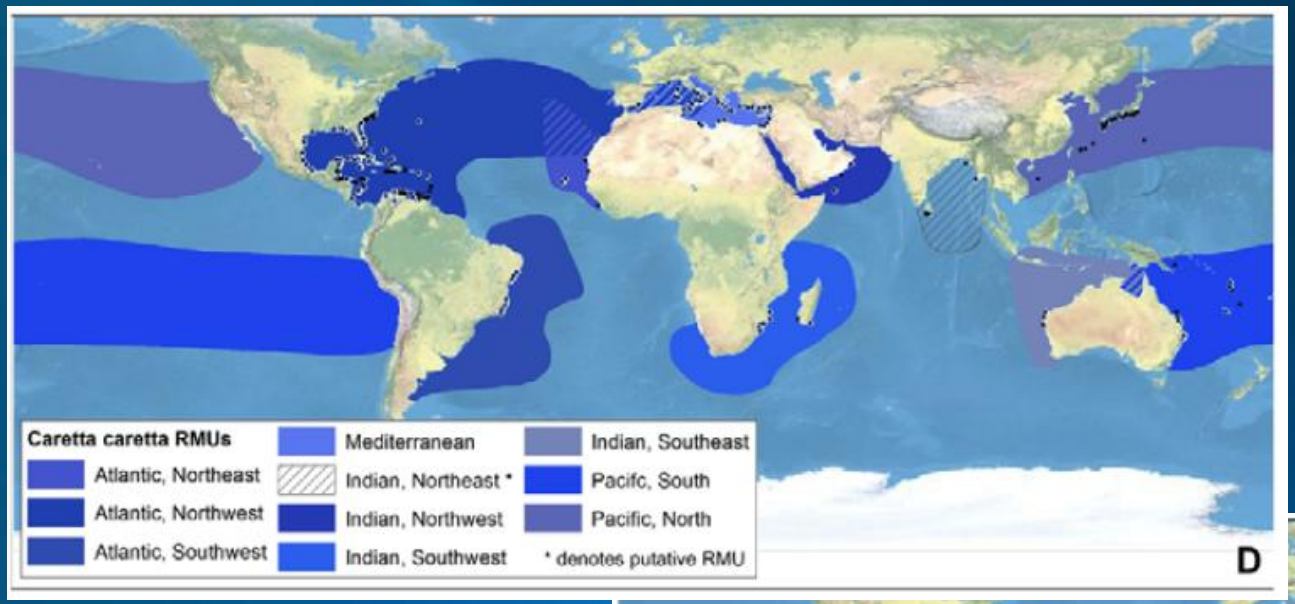
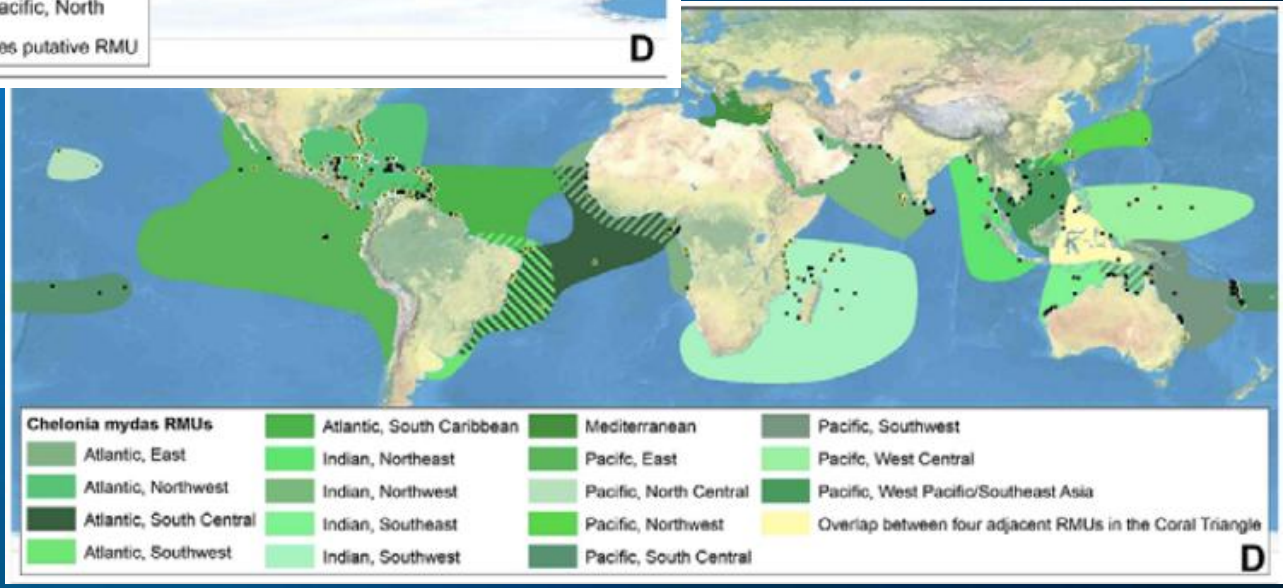
- Mediterranean sea turtle bycatch and fisheries management

Sea Turtles: RMUs in Mediterranean





Wallace BP, DiMatteo AD, Hurley BJ, Finkbeiner EM, Bolten AB, et al. (2010) Regional Management Units for Marine Turtles: A Novel Framework for Prioritizing Conservation and Research across Multiple Scales. PLoS ONE 5(12): e15465. doi:10.1371/journal.pone.0015465

Bycatch definition

GFCM Data Collection Reference Framework, 2015

- *In fisheries, bycatch is the part of the catch unintentionally captured with a gear in addition to target species during fishing operation (e.g. undersized and damaged specimens) and non-commercial species as well as incidental catch of endangered, vulnerable or rare species (e.g. turtles, sharks, mammals, birds, ...).*

Six of the seven species of sea turtles are threatened with extinction and longline fisheries may have significant population-level impacts in some regions

Understanding how sea turtles bycatch happens (Lewison et al., 2013)

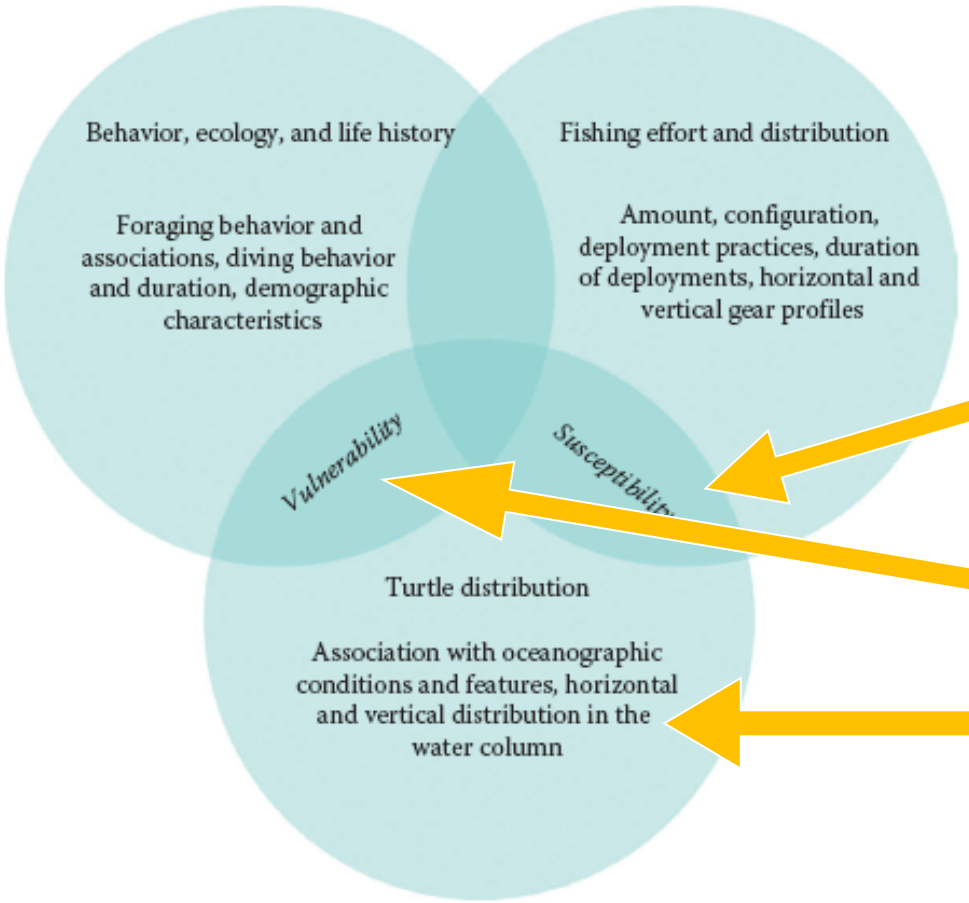


FIGURE 12.1 A conceptual model of the different factors that drive sea turtle bycatch. Vulnerability is primarily driven by ecological and life history attributes and characteristics that govern behavior and distribution. Susceptibility, in contrast, is driven largely by the horizontal and vertical overlap of fishing vessels and sea turtles, and represents the elements in the system that can be managed.

FISHERIES MANAGEMENT

Fishing strategy

Technological changes in gears

Resolutions

Climatic oscillations, NAO,

Climate changes

CLIMATIC

A context for Bycatch

- Its gear-type, multi-fishery cumulative and trans-national, affecting several taxa
- Bycatch varies across ocean areas; effects are at population-level
- Information is incomplete. Data gaps include industrial and SSF fleets
- Overall mortality is unknown
- RFMOs implementing measures to reduce bycatch, including the use of onboard tools
- The level of monitoring and control of management measures related to bycatch is poor
- Science only isn't the solution.

Surface longline bycatch worldwide

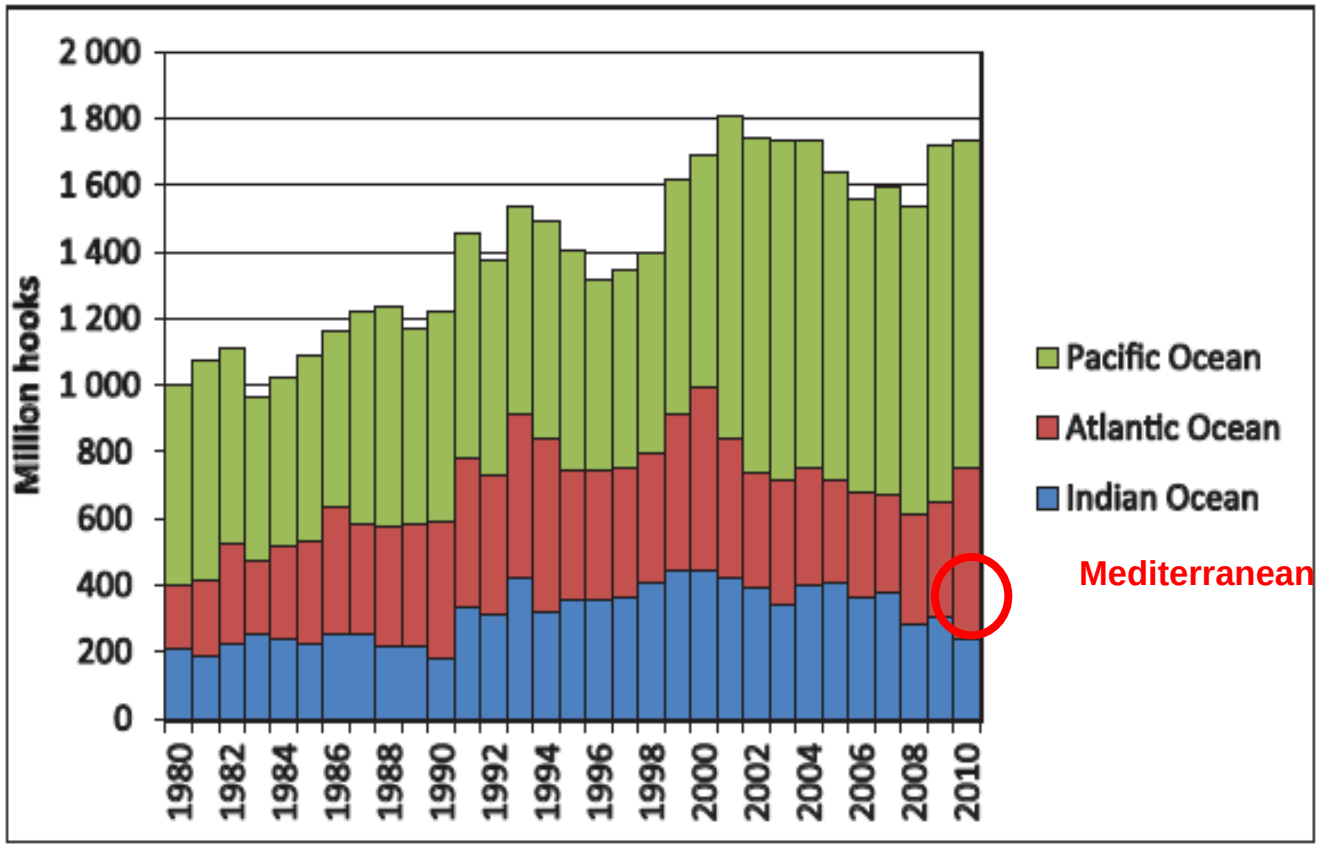
- A big fleet: there may be up to 7.500 tuna longliners.
- Interactions with pelagic longline fisheries kill thousands of seabirds, elasmobranch, marine mammals and turtles.
- At least 650 species of other bony fishes may be caught in association with pelagic longline fisheries, e.g. dolphin fish, ocean sunfish.
- Effects on the ecosystem and non-target populations are of paramount importance.

Source: FAO 2014

Clarke, S., Sato, M., Small, C., Sullivan, B., Inoue, Y. & Ochi, D. 2014. *Bycatch in longline fisheries for tuna and tuna-like species: a global review of status and mitigation measures*. FAO Fisheries and Aquaculture Technical Paper No. 588. Rome, FAO. 199 pp.

FIGURE 6

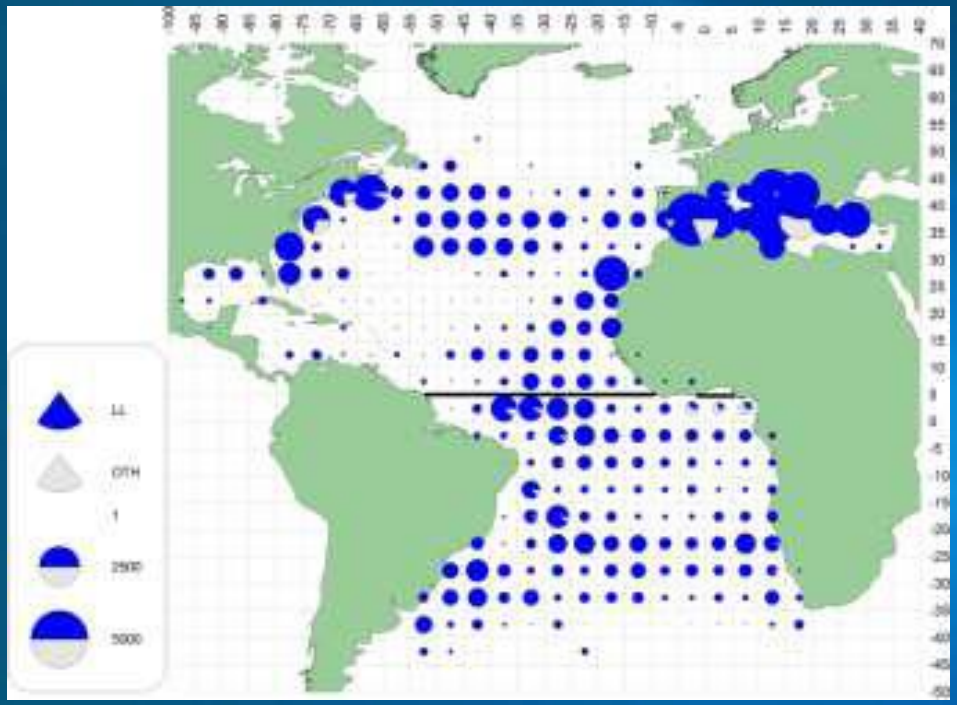
Global longline effort by ocean, 1980–2010



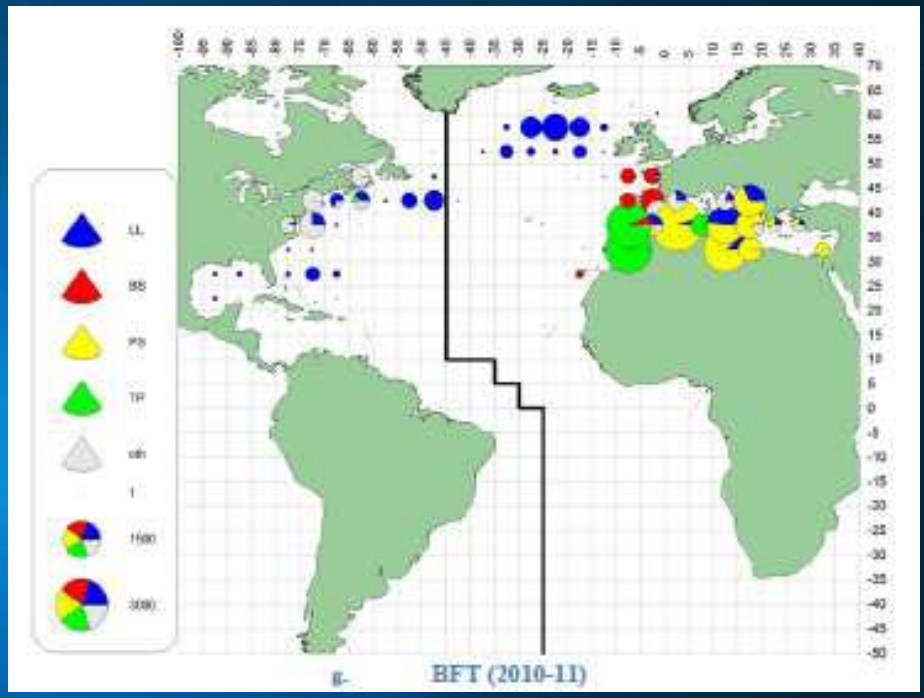
Note: Effort figures for the Pacific include both the Eastern and Western and Central Pacific.

Sources: ICCAT T2CE database (downloaded 13 March 2013; ICCAT, 2013); IOTC (2012b); M. Herrera (personal communication, March 2013); P. Williams (personal communication, March 2013).

ICCAT: The major longline catches for swordfish and bluefin tuna



Geographical distribution of swordfish catches in the Atlantic Ocean and Mediterranean Sea, by gear type, from 2000 to 2009 (Anon. 2011).



Geographical distribution of bluefin tuna catches in the Atlantic Ocean and Mediterranean Sea, by gear type, from 2010 to 2011 (Anon. 2011).

Average annual reported catches of Swordfish in the Mediterranean (about 13,408 t from 1988 to 2013) are similar to those of the North Atlantic

Understanding global longline fishery: baits

- Estimates suggest that the bait used amounts to about a ratio 0,5/1.
- Concerns about indirect impacts on the ecosystem and energy inputs.
- In addition, changes in the choice of bait species may influence interactions with bycatch species.

Source: FAO, 2014

Sea turtle bycatch, a global threat

- The **viability** of fisheries when introducing reduction bycatch strategies (Gilman et al., 2006).
- Underestimates global bycatch. <1% fishing effort observed and under represented SSF (Wallace et al. 2010).
- The highest bycatch rates occurred in the East Pacific, West Atlantic, and **Mediterranean** regions (Wallace et al., 2013).
- Fisheries that interact with sea turtles within the ICCAT region (Coelho et al 2013).
- FAO, 2014: 3rd Publication reviewing bycatch in global tuna fisheries and it deals with longline fisheries.

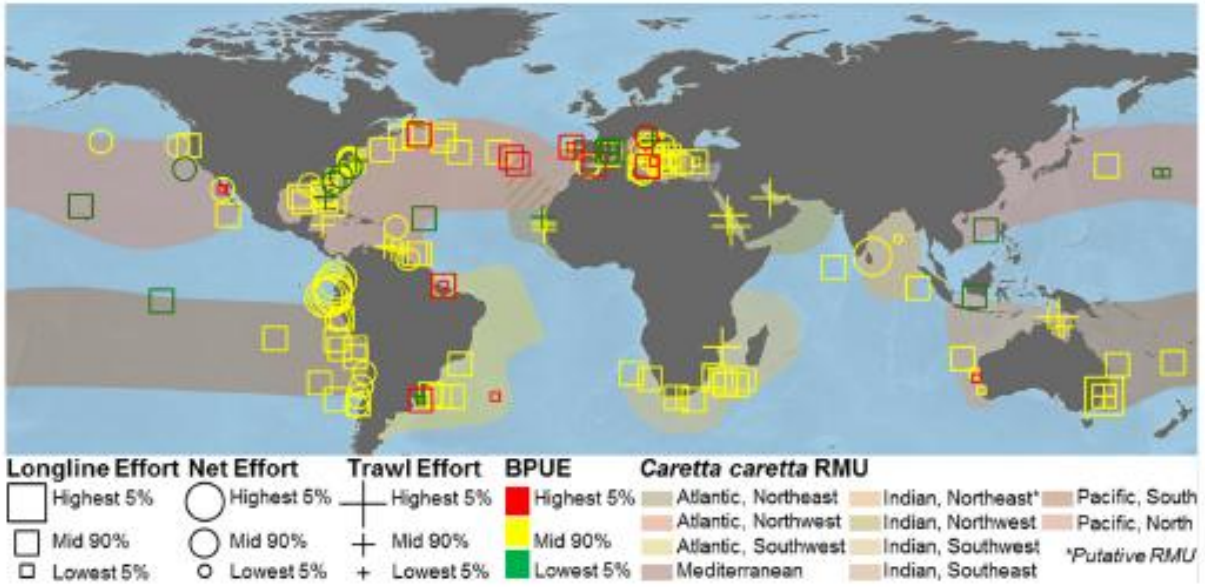


Fig. 4. Global distributions of bycatch records of loggerheads (*Caretta caretta*) in relation to their respective regional management units (RMUs; Wallace et al. 2010). Gear and bycatch per unit effort (BPUE) symbology is identical to global gear maps (Fig. 1), but symbol sizes and colors correspond to low, medium, and high values for each gear-species category. Because many points had identical coordinates, not all points are visible; records with high BPUE values were prioritized, followed by low and then medium values, for display. Where bycatch locations were not provided in the original source, records were mapped relative to general area of operation for the fishery reported.

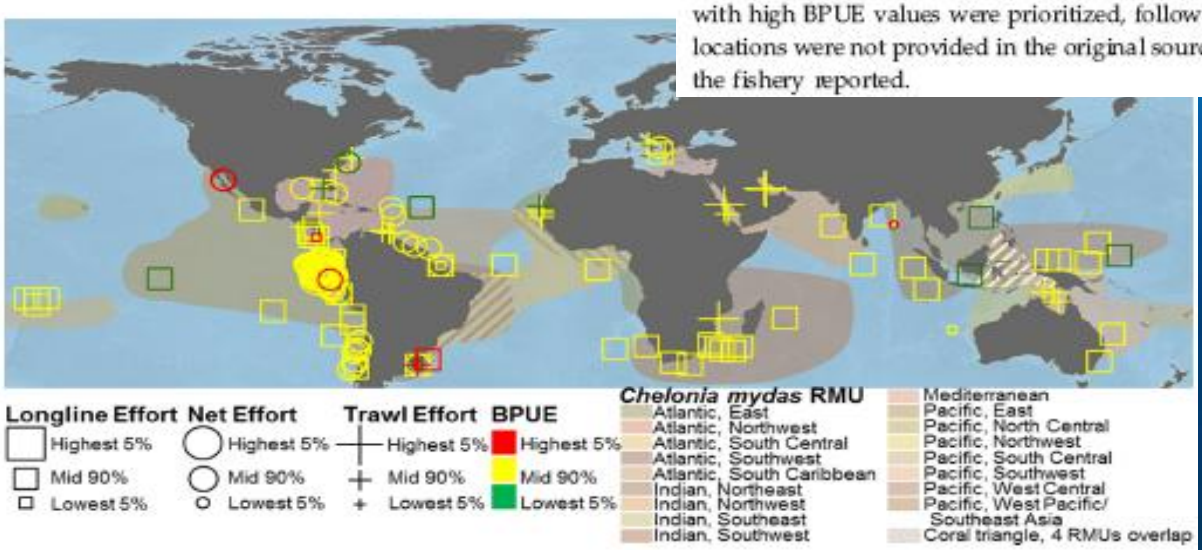
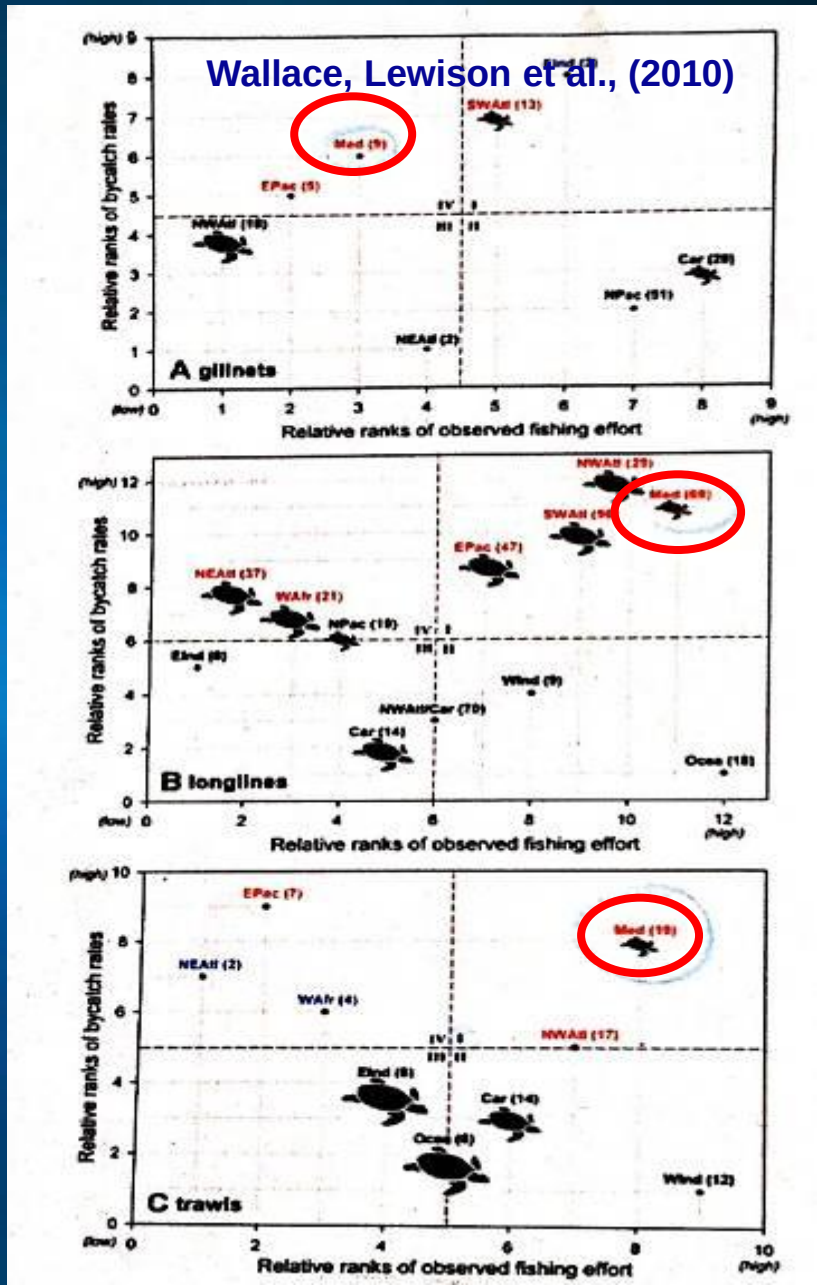


Fig. 5. Global distributions of bycatch records of green turtles (*Chelonia mydas*) in relation to their respective

Bycatch of Mediterranean sea turtles in a global context

- Affecting mainly small turtles (low reproductive value).
- High bycatch rates related to high observed fishing effort.
- **BPUE** and **observed** effort are among highest in the world.
- High bycatch rates in Mediterranean Sea recommended urgent conservation priorities.



Mediterranean bycatch may be due to most fishing gears

- Spatial overlap of both oceanic and neritic foraging patterns of turtles with areas of longline and trawl fisheries activity. Both oceanic and neritic turtles stages are at risk of bycatch (Laurent et al., 2001; Tudela (2004); Casale .
- Trawl fisheries are responsible for significant bycatch of loggerhead + green sea turtle in the Mediterranean (Casale *et al*. 2007, Álvarez de Quevedo *et al*. 2010, others)
- Loggerhead + green turtles are also at risk from small scale artisanal fisheries as has been reported elsewhere (Carreras et al. 2004, Echwikhi et al. 2010, Coelho et al., 2013).
- Turtle bycatch can vary depending on many factors such as gear characteristics and fishery strategies, seasonality or bio-geographic factors (Camiñas & Valeiras, 2001, Báez et al. 2010, Álvarez de Quevedo et al. 2010, Casale 2011).
- Any strategy to reduce bycatch and estimate adequate figures in the Mediterranean region would require a multi-gear approach.

After Casale, 2011: FISH AND FISHERIES Vol 12 (3): 299-316

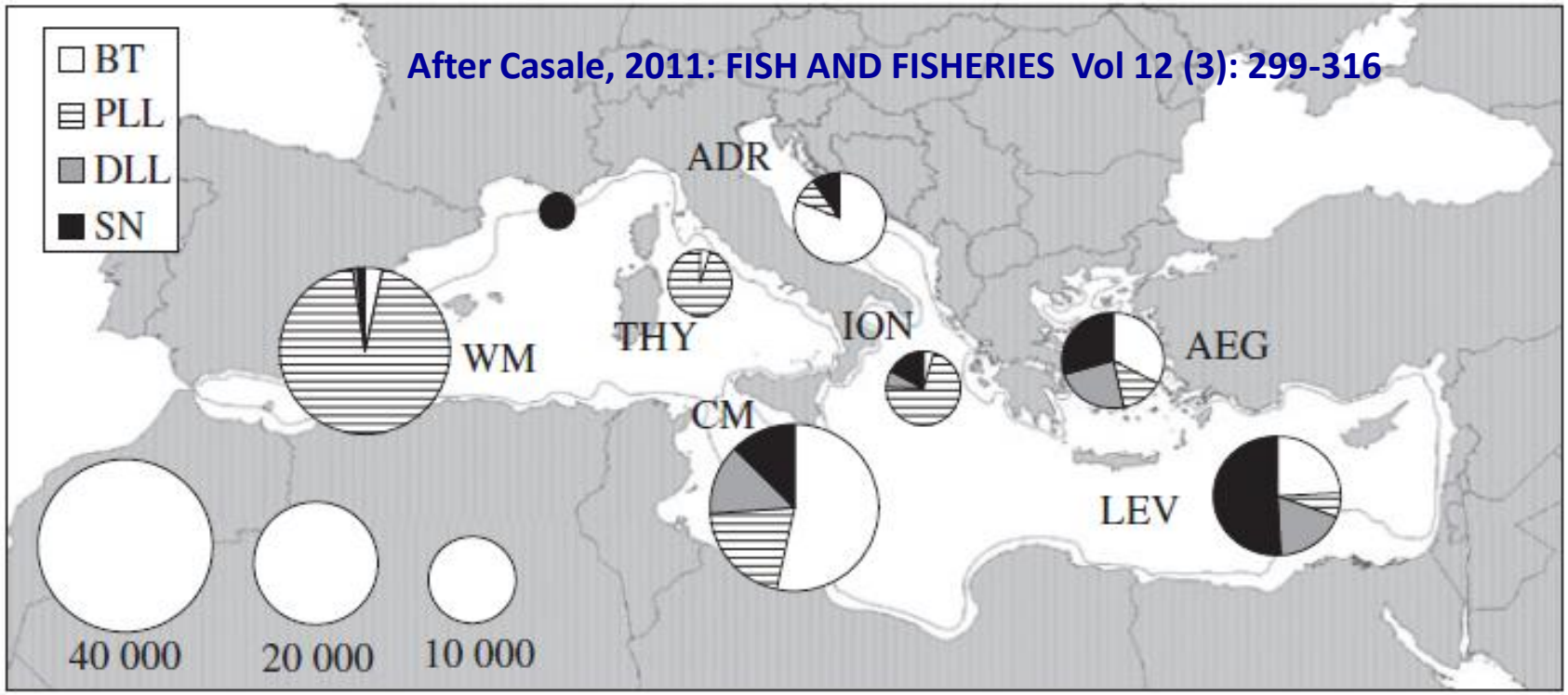


Figure 2 Proportions of turtles captured annually in the Mediterranean by sea area and fishing gear estimated from fishery statistics and catch rates. BT, bottom trawl; PLL, pelagic longline; DLL, demersal longline; SN, set net. Sea areas: ADR Adriatic; AEG Aegean; CM central Mediterranean; ION Ionian; LEV Levantine basin; THY Thyrrenian; WM: western Mediterranean. The 200-m bathymetry line is shown. Data aggregated as follows. ADR: SI HR AL IT (Adriatic side); AEG: GR (east) TR (west); CM TN LY MT IT (central Med); ION: GR (west) IT (Ionian); LEV: CY EG SY; TR (Levantine); THY: IT (Thyrrenian); WM: ES MA DZ; France is not aggregated. No data available for BA, LB, MC and ME.

Gaps in the bycatch data

- **Mediterranean fisheries**: Limited data
- Few national on-board observers programs or covering very few industrial fisheries
- Lack of information on many coastal fisheries
- Data deficient or no data from many countries and areas heavily fished by commercial fleets
- GFCM Data Base incomplete; ICCAT Data Base useful but incomplete information
- Other sources: EMODNet of EU: gaps in EU available data. RAC-SPA and other IOs

Proposal: Improve information at national level involving all stakeholders

SSF: we have some numbers….

year 2008	TRWL	PSSP	POLY	PST	ART	TOTAL	
ALBANIA	180	22			67	**269**	0,33%
ALGERIA	487	1039		7	2908	**4441**	5,42%
CROATIA	800	400		23	2600	**3823**	4,66%
CYPRUS	8	1	28	1	628	**666**	0,81%
EGYPT	1095	238			1791	**3124**	3,81%
France	111	24	27	32	1079	**1273**	1,55%
GREECE	311	281	511	2	16250	**17355**	21,16%
ISRAEL	31	19			388	**438**	0,53%
ITALY	3520	305	292	46	9258	**13421**	16,37%
LEBANON		70			2590	**2660**	3,24%
LIBYA	140	165		29	4695	**5029**	6,13%
MALTA	17		114	3	1018	**1152**	1,40%
MOROCCO	119	150	112	3	2974	**3358**	4,10%
MONTENEGRO	30	18			170	**218**	0,27%
PALESTINE	18	67			632	**717**	0,87%
SLOVENIA	20	9			152	**181**	0,22%
SPAIN	840	277	168	6	2052	**3343**	4,08%
SYRIA	21	5	30		1157	**1213**	1,48%
TUNISIA	399	360	227	24	10316	**11326**	13,81%
TURKEY	300	167	33	86	7406	**7992**	9,75%
TOTAL	**8447**	**3617**	**1542**	**262**	**68131**	**81999**	
	10,30%	4,41%	1,88%	0,32%	83,09%		

Table 1. Composition of the Mediterranean national fishing fleets by *métier* for the year 2008: TRWL = trawlers and dredgers, PSSP = purse seiners for small pelagic, POLY = polyvalent vessels > 12 m, ART = artisanal (small scale) boats, PST = tuna purse seiners, MAD = traps (Source: Sacchi, 2011).

Farrugio, 2013. Mediterranean and Black Sea SSF Symposium

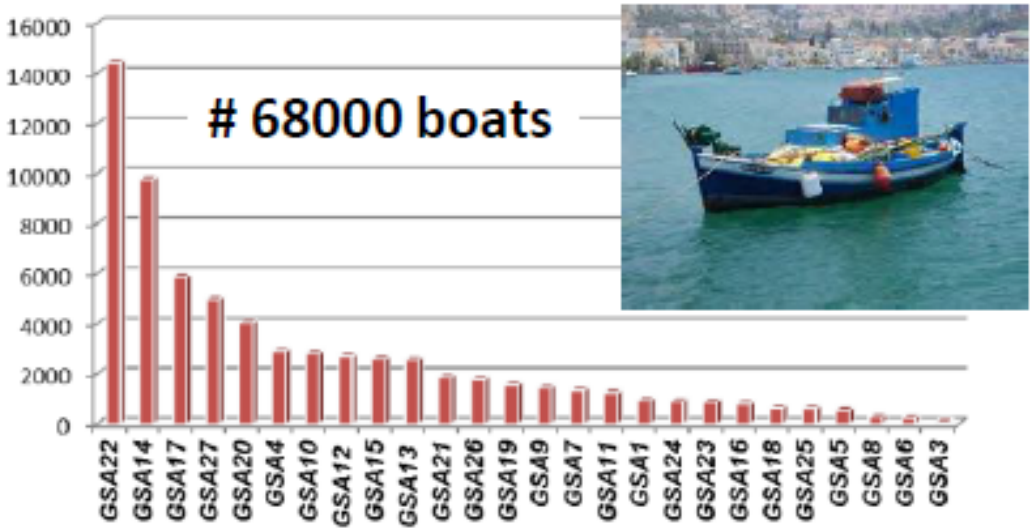
FLEETS SIZES

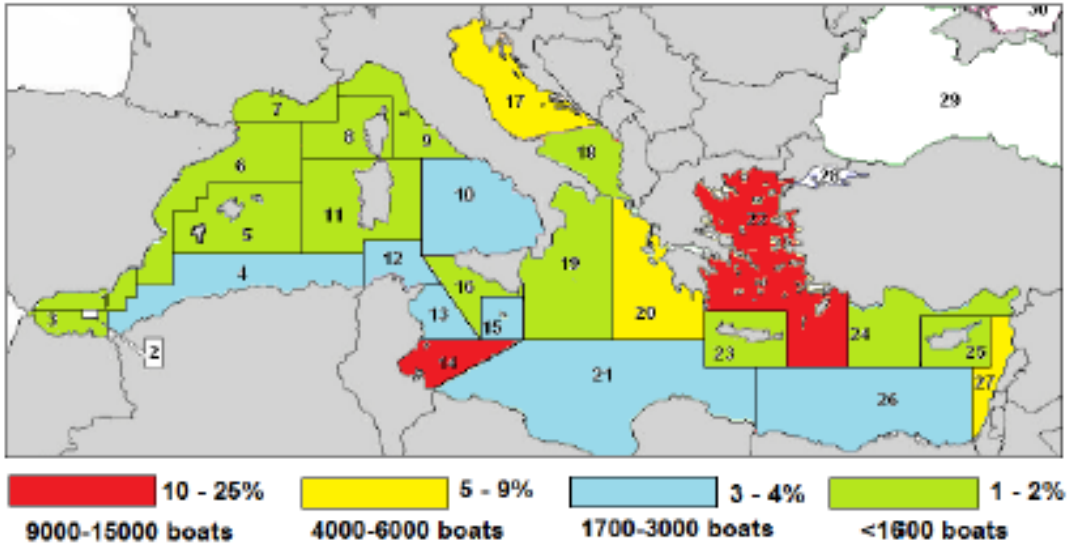
GSA22 Aegean sea	14447
GSA14 Gulf of Gabes	9776
GSA17 Northern Adriatic	5860
GSA20 Eastern Ionian sea	4051
GSA4 Algeria	2908
GSA10 South & central Thyrenian	2810
GSA12 Northern Tunisia	2697
GSA27 Lebanon	2662
GSA15 Malta island	2587
GSA13 gulf of Hammamet	2562
GSA21 Lybia	1866
GSA26 Egypt	1791
GSA19 Western Ionian sea	1559
GSA9 Ligurian & North Thyrrenian	1437
GSA7 Gulf of Lions	1346
GSA11 Sardinia	1244
GSA27 Syria	1157
GSA1 Northern Alboran sea	929
GSA24 North Levant	904
GSA23 Crete island	892
GSA16 South of Sicily	811
GSA18 Southern Adriatic	640
GSA27 Palestine	632
GSA25 Cyprus	628
GSA5 Balearic islands	542
GSA27 Israel	519
GSA8 Corsica Island	270
GSA6 Northern Spain	234
GSA3 Southern Alboran sea	70

50%

data from GFCM task1

data from other sources





Farrugio, 2013. Mediterranean and Black Sea SSF Symposium

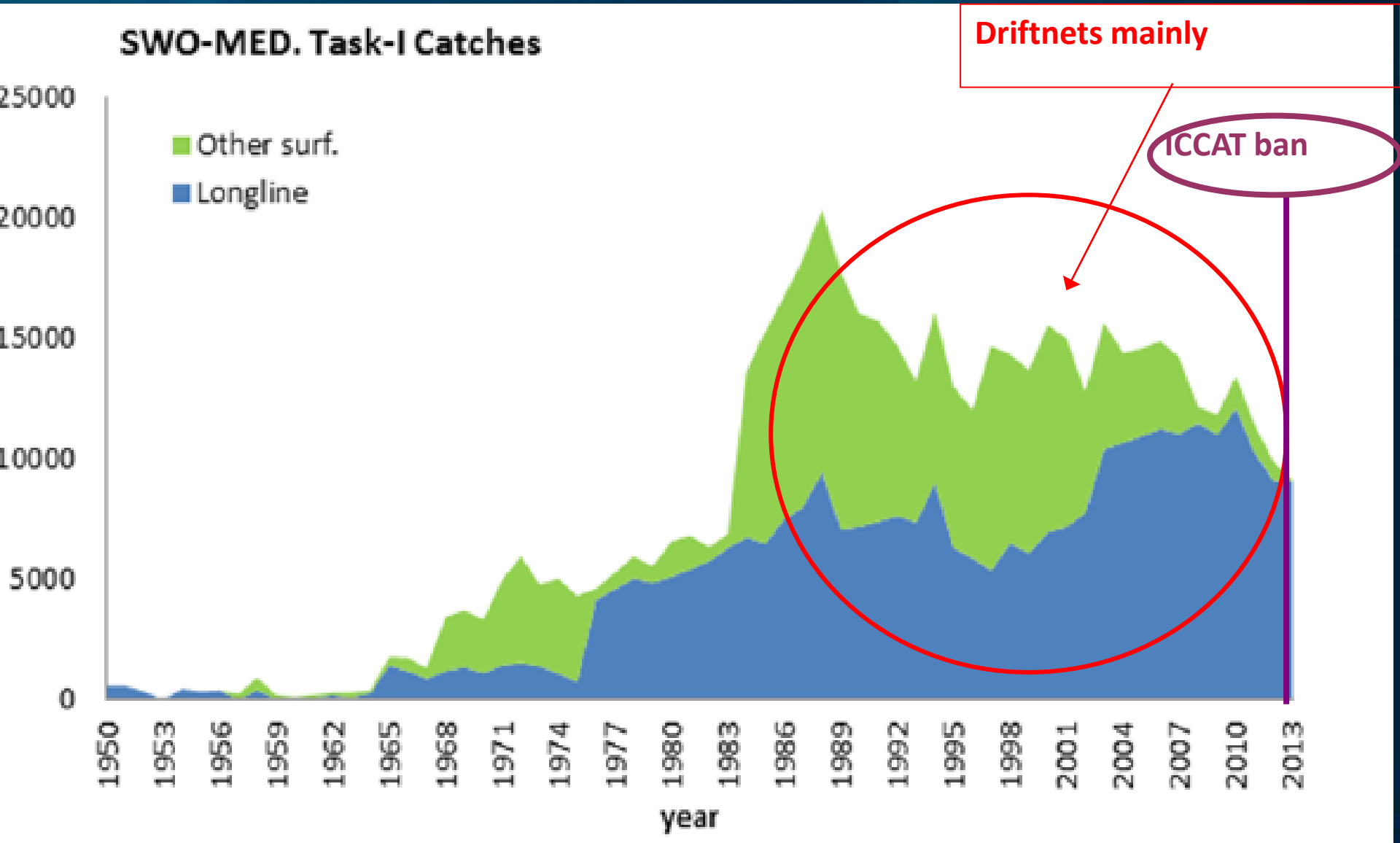
		gillnets & entangling nets	hooks & lines	traps	miscellaneous gear	seine nets	surrounding nets	other gear	gear not known	dredges	trawls	lift nets	harvesting machines	total
GSA1 Northern Alboran sea	B	74	5	28		3				32				**142**
929 Boats		616	3	135		33								**787**
GSA3 Southern Alboran sea	B													**0**
70 Boats	C		70											**70**
GSA5 Balearic islands	B	3	2	1						1				**7**
542 Boats	C	132	111	74	28		190							**535**
GSA6 Northern Spain	B													**0**
234 Boats	C	196		38										**234**
GSA7 Gulf of Lions	B	64	20	151	65	4	1	107	29	10	1	1		**453**
1346 Boats	C	306	83	97	170	12	9	119	72	13	9	2	1	**893**
GSA8 Corsica Island	B	12	6	3		1		7	5					**34**
270Boats	C	129	32	13		2	2	31	27					**236**
GSA9 Ligurian & North Thyrrenian	B	216	16	16	11	53								**312**
1437 Boats	C	718	100	7	19	260	21							**1125**
GSA10 South & central Thyrenian	B	449	249		17	79								**794**
2810 Boats	C	984	485			287	246				14			**2016**
GSA11 Sardinia	B	112	37	107										**256**
1244 Boats	C	459	218	298							13			**988**
	A	957	215											**1172**
GSA12 Northern Tunisia	B	150	40											**190**
2697 Boats	C	935	300					100						**1335**
	A	1078	250											**1328**
GSA13 gulf of Hammamet	B	150	20											**170**
2562 Boats	C	664	300	100										**1064**
	A	3885	2000	300				200						**6385**
GSA14 Gulf of Gabes	B	200	20	40										**260**
9776 Boats	C	2031	300	800										**3131**
GSA15 Malta island	B	323	703	332	7		1							**1366**
2587 Boats	C	258	605	214		7	137							**1221**
GSA16 South of Sicily	B	165	43			10					10			**228**
811 Boats	C	375	146				62							**583**
GSA17 Northern Adriatic	B	514		536										**1050**
2938 Boats	C	634		1157	93						4			**1888**
	A		11											**11**
GSA18 Southern Adriatic	B	103	41			204								**348**
640 Boats	C	174	39			68								**281**
GSA19 Western Ionian sea	B	243	108			123								**474**
1559 Boats	C	564	149	13	9	227	123							**1085**
	A	61	32			1								**94**
GSA20 Eastern Ionian sea	B	1001	438	8		2								**1449**
4051 Boats	C	1748	630	13		115				2				**2508**
	A	98	71	2						1				**172**
GSA21 Aegean sea	B	2494	1593	57	340	1				14				**4499**
14447 Boats	C	4022	2279	258	2950	233				34				**9776**
	A	2	12											**14**
GSA23 Crete island	B	157	152											**309**
892 Boats	C	311	247			11								**569**
GSA24 North Levant	B				71									**71**
904 Boats	C				833									**833**
Total = 52746 boats		**27767**	**12181**	**4798**	**4613**	**1736**	**792**	**564**	**133**	**107**	**51**	**3**	**1**	**52746**
		52,64%	23,09%	9,10%	8,75%	3,29%	1,50%	1,07%	0,25%	0,20%	0,10%	0,01%	0,00%	

Farrugio, 2013. Mediterranean and Black Sea SSF Symposium

Fleets targeting Swordfish in the Mediterranean with surface longline

- The biggest producers (82% of total) of swordfish in the Mediterranean Sea (2003-2013) are Italy (41%), Morocco (14%), Spain (10%), Greece (9%) and Tunisia (8%).
- Algeria, Cyprus, Malta and Turkey have fisheries targeting swordfish in the Mediterranean and minor catches reported by Albania, Croatia, France, Japan, and Libya.
- Additional fleets taking swordfish in the Mediterranean, as Egypt, Israel, Lebanon, Monaco and Syria, but the data are not reported to ICCAT or the FAO.

ICCAT, 2014. REPORT OF THE 2014 ICCAT MEDITERRANEAN SWORDFISH STOCK ASSESSMENT MEETING (Heraklion, Greece – July 21 to 25, 2014)

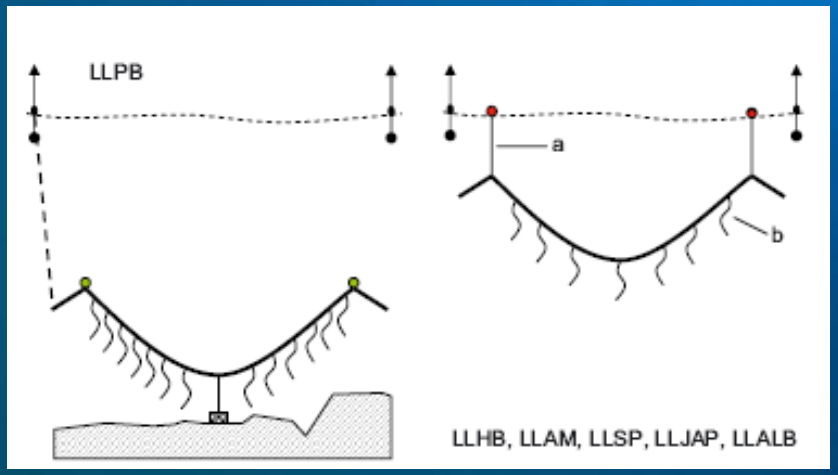


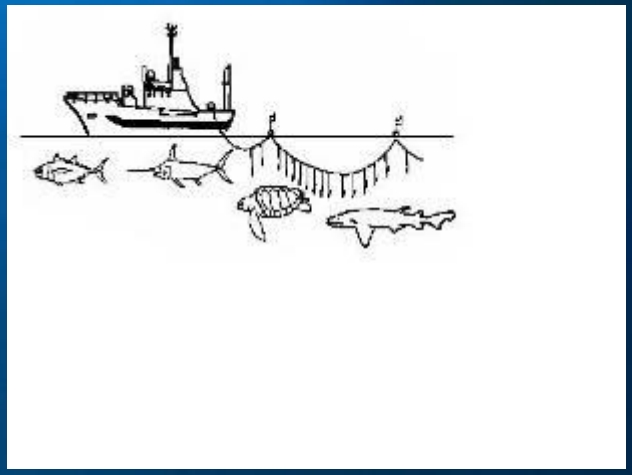
ICCAT 2014. REPORT OF THE 2014 ICCAT MEDITERRANEAN SWORDFISH STOCK ASSESSMENT MEETING (Heraklion, Greece – July 21 to 25, 2014)

Fishing gears evolution

- Historically main fishing gears targeting swordfish in Mediterranean are **surface longline and gillnets**.
- Since 2012, **gillnets eliminated** following ICCAT general ban of driftnets in the Mediterranean.
- Around 800 drifting longline are estimated targeting swordfish in Italy after the driftnets ban
- A **mesopelagic longline gear** has been gradually introduced (from 2007 in Spain and from 2010 in Italy) and replaced the surface longline gear in almost all Italian fleets.

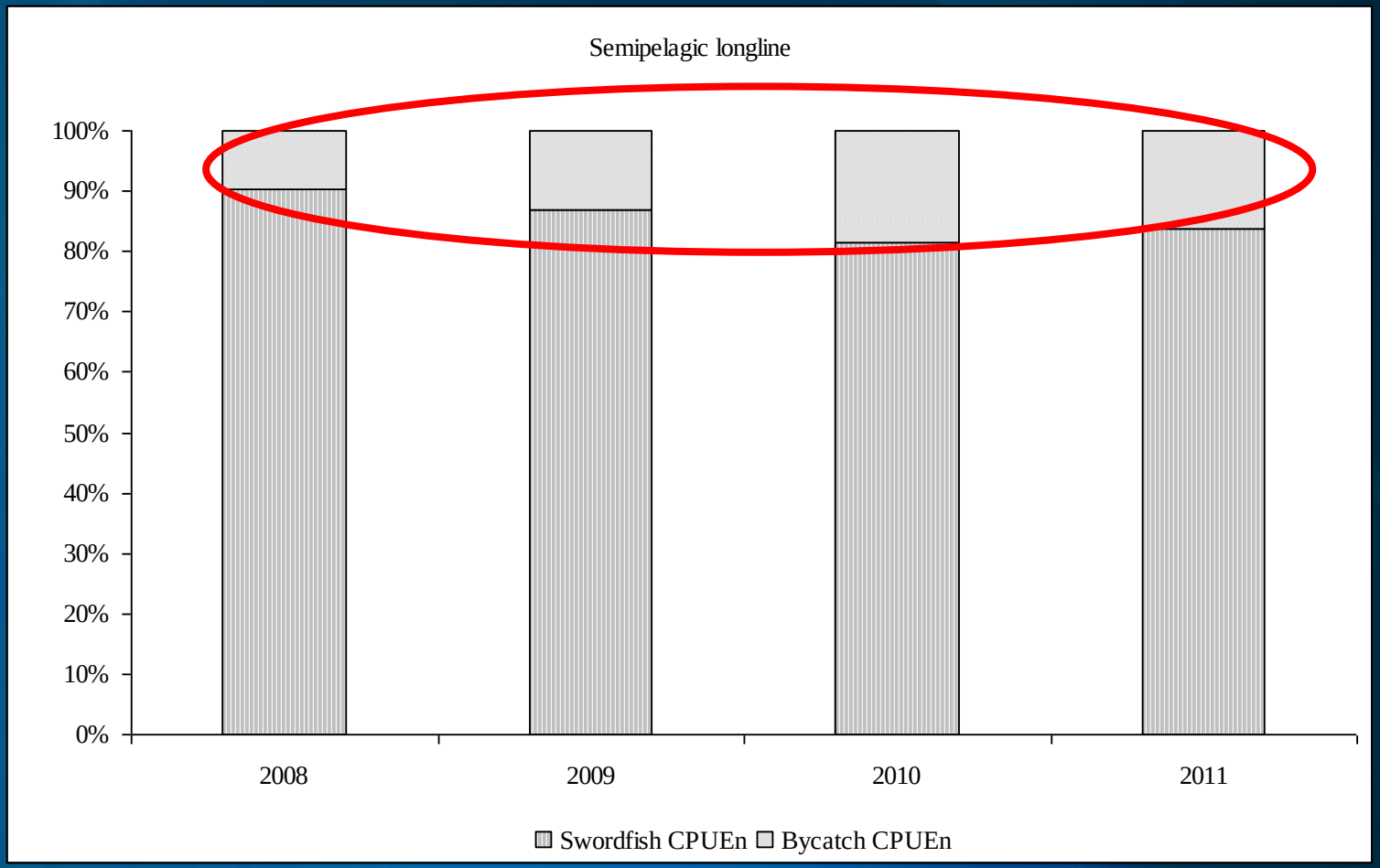
This is particularly significant because the changes have implications for the catch rates of bycatch sea turtles





The semi-pelagic longline LLSP, Is it really effective in reducing by-catch?

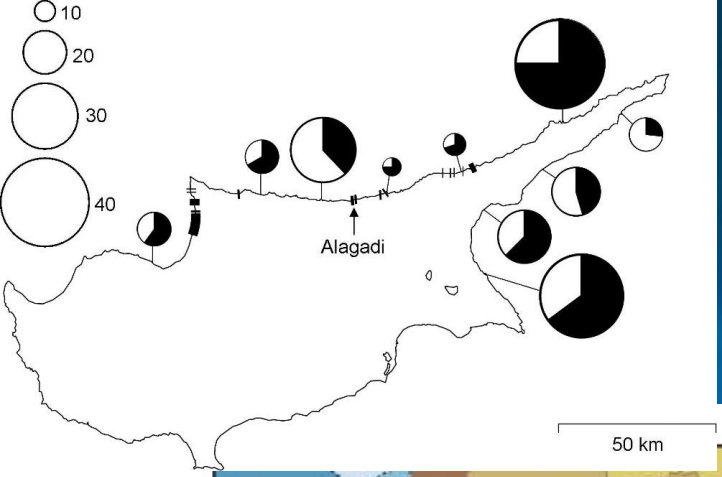
- deepest waters (150–200m) that surface long-lines
- longer time at sea (about 39.05 ± 0.37 h).
- the number of hooks per set decrease (1500) to achieve a feasible working time.
- The ratio swordfish/bycatch represent that about 90% of the total catch correspond to swordfish (data 2008-2011)
- Mainly used in summer months
- Bycatch with very low catches of sea turtles and sharks.



García-Barcelona et al., 2010 (Aq. Liv. Res., 23); SCRS 2012

Other fleets with potential or real bycatch

- North Cyprus SSF, mainly trammel nets (Snape et al. 2010): as many as 1000 turtles (Green and Loggerhead) annually with an estimated mortality rate of 60%.
- Greek-Cyprus 280 LL vessels (Damalas and Megalofonou, 2012); 160 vessels in 2013 (ICCAT, 2014)
- France: bycatch and stranding. Claro et al., 2013. ICCAT
- Artisanal fisheries in Gulf of Gabès
- SSF in coastal areas of Israel (Levy et al., 35 Symposium)



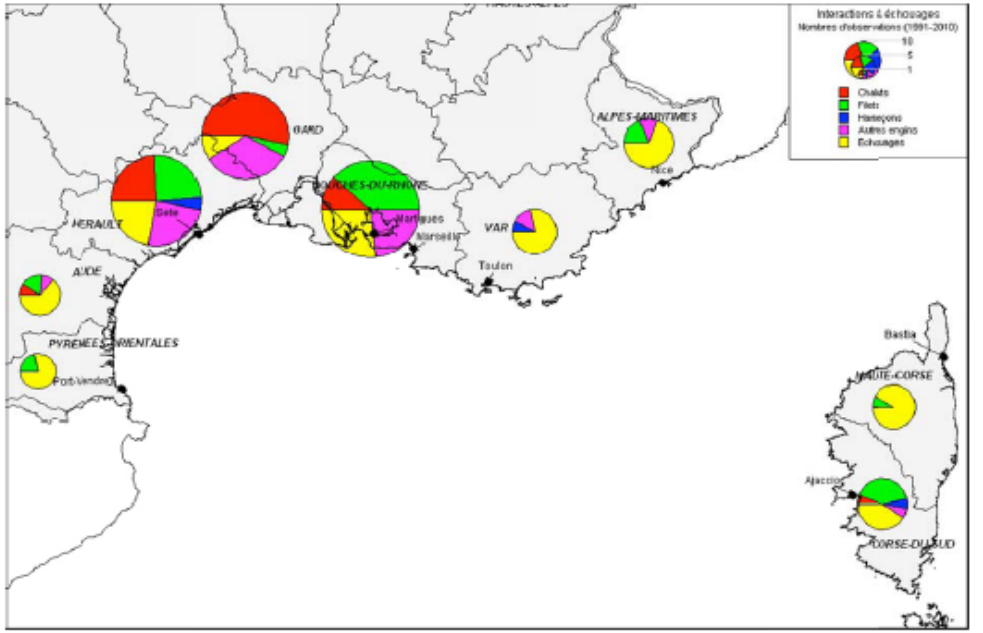


Figure 2. Strandings of sea turtles and interactions of sea turtles with fishing devices on the French Mediterranean coast between 1991 and 2010 (data of Réseau Tortues Marines de Méditerranée Française and Banaru et al. 2011). In red= interactions with trawlers; in green= interactions with gillnets ; in blue= interactions with liners ; in pink= interactions with other fishing devices ; in yellow= sea turtle strandings.

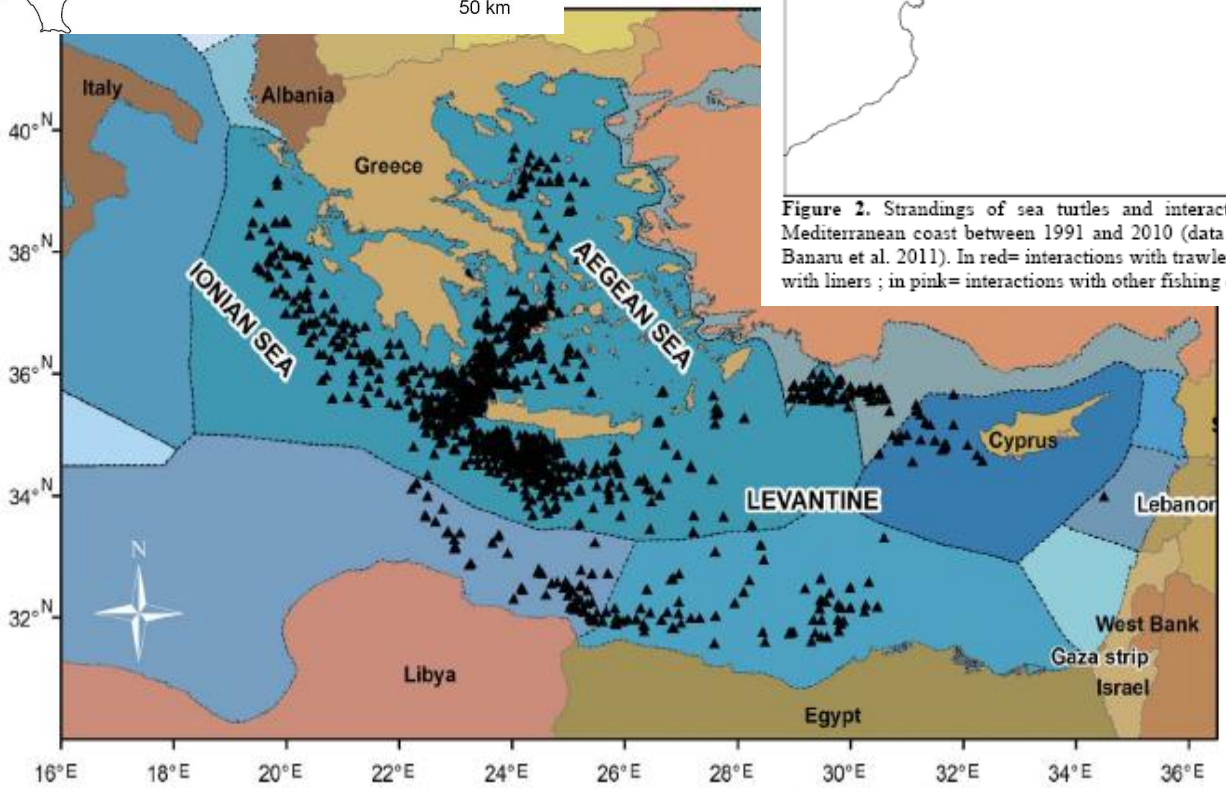
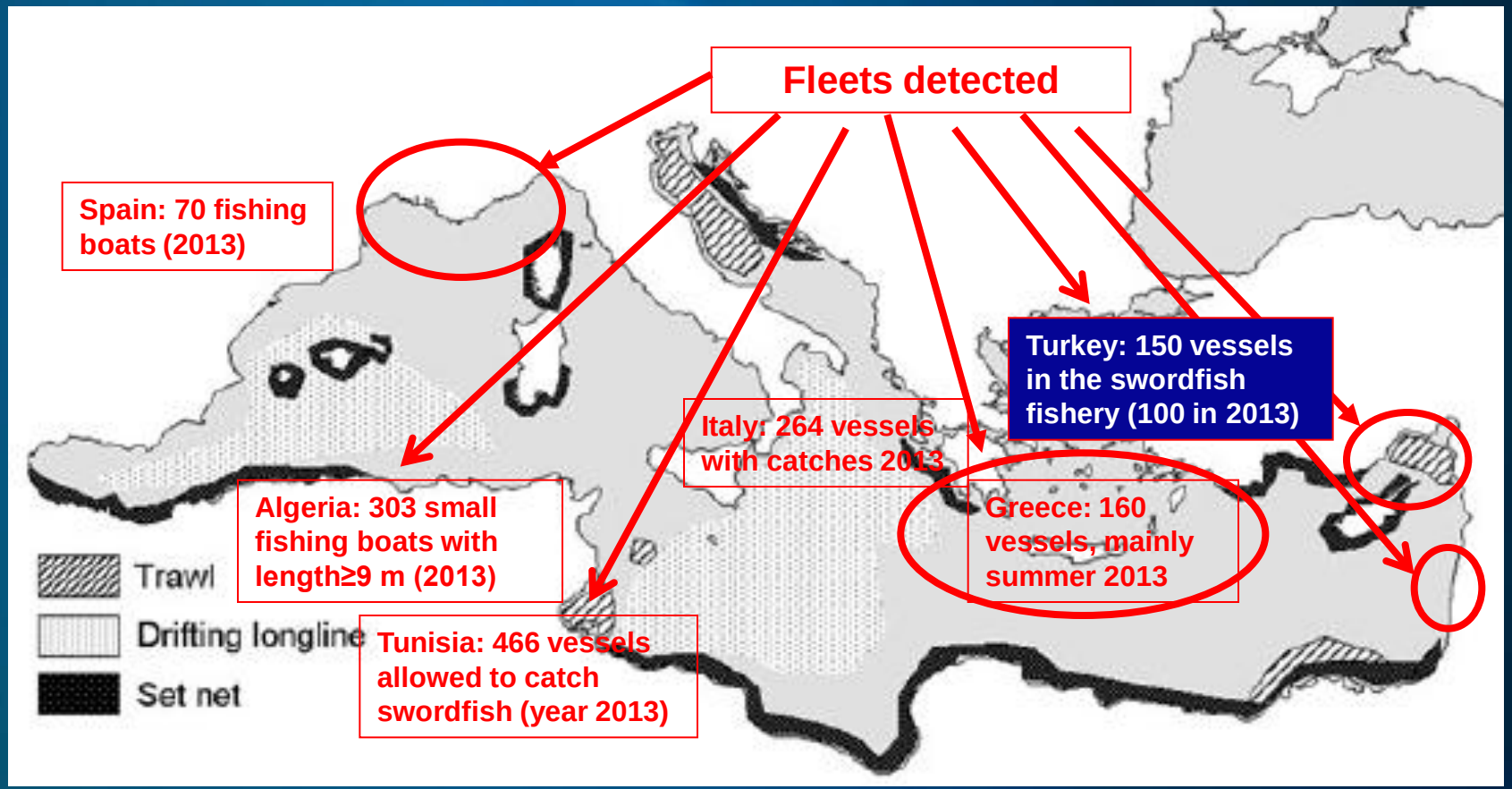


Figure 1 Map of the study area in the south-eastern Mediterranean Sea. Fishing locations are indicated by black solid triangles. Shaded marine regions designate potential Exclusive Economic Zones (EEZ) as provided by Flanders Marine Institute (VLIZ). Available from http://www.vliz.be/vmdcdata/marbound/. (To date, very few Mediterranean countries have claimed an EEZ.)

Summarizing turtle bycatch/gear

(Lucchetti & Sala, 2010)



New fleets of bycatch concern (ICCAT, 2014)

Known Bycatch and mortality by gear type in the Mediterranean Sea

	Gears	Total captures	Direct mortality
Casale, 2011 17 Mediterranean Countries	All gears studies Bottom trawler Pelagic longline Bottom longline Nets	>132.000 year 39.000 57.000 13.000 23.000	>44.000/deaths/year 7.800 deaths/year
Benhardouze et al 2012 Morocco	Driftnets, surface longline, bottom longline	719 C caretta 101 D. coriacea 51 turtles 91 turtles	6.25% estimated no mortality 16.6% mortality

Table 13. Summary of the collected on sea turtle hooking mortality rates after interactions with longline fishing gear for the Mediterranean Sea. On the data source FO = onboard fishery observers, Sci = research cruises or commercial vessels during experimental fishing trials.

Reference	*Species*	*N*	*Region*	*% Alive*	*% Dead*	*Source*
Aguilar et al. (1995)	*C. caretta*	1,098	Western Med	99.996	0.004	FO
Laurent et al. (2001)	Sp comb.	23	Greece	95.7	4.3	FO
	Sp comb.	214	Ionian Sea	100	0	
	Sp comb.	676	Spain (W. Med)	97.4	2.6	
Camiñas et al. (2003)	*C. caretta*	2,125	Western Med	96.6	3.4	FO
Camiñas et al. (2006)	*C. caretta* (BFT)	746	Western Med	98.26	1.74	FO
	C. caretta (BFTr)	54		98.15	1.85	
	C. caretta (SWA)	125		98.4	1.6	
	C. caretta (SWB)	1837		99.46	0.54	
	C. caretta (SWBr)	354		95.76	4.24	
	C. caretta (ALB)	354		98.59	1.41	
	C. caretta (All)	3,480		98.68	1.32	
Jribi et al. (2008)	*C. caretta* (Surface LL)	33	Gulf of Gabes	100	0	FO
	C. caretta (Bottom LL)	24		87.5	12.5	
Anon (2008)	*C. caretta*	77	Balearic Isl (W Med)	92.2	7.8	Sci
	C. caretta	2	Ionian Sea (E Med)	100	0	
Echwikhi et al. (2010a)	*C. caretta*	29	Gulf of Gabes	79.3	20.7	FO

Bycatch issues on LL

Based on literature, Luchetti & Sala, 2010 summarize LL, Trw, Driff, botttom, etc.

- Circle hooks reduce mortality in certain fisheries/areas
- Direct mortality in LL is relatively low. Around 80 % of sea turtles are liberated alive (Spanish LL)
- The length of the branch line in liberated turtles is a cause of concern and delayed mortality in the long term
- Depth of the longline could severely affect mortality
- Trawlers produce important direct mortality
- Mortality related to time setting: more time more turtles captured

Alvarez de Quevedo et al, 2013

- Post-released additional mortality could reach 17-40 % of liberated sea turtles with hooks-lines

Methods for the assessment of sea turtles bycatch

- Modelling **capture rates**:
  - Models (binomial GLM, GAM, mixed). Options depending of the data itself and the underlying assumptions. Consider response variable (Nº or Kg/1000 hooks) and explanatory variables of BPUE (as vessel, year,, area, SST, soak time, etc.)
  - Address the problem of zero catches, common in turtle bycatch
- Analyzing and modelling **mortality rates**,
  - Response variable: binomial (1 the turtle died; 0= the turtles release alive)
  - Explanatory variables (a combination of discrete and continuous variables): specimen size; time until release;
  - Models: binomial GLM; short-term mortality, etc.
- Methods for conducting Ecological Risk Assessment (ERA): Level 1, qualitative analysis; Level 2, semi-quantitative; Level 3, Fully quantitative.
  - Productivity/Susceptibility parameters (tables by species)

ERA results (preliminar) for RMUs in Mediterranean Sea

- The Med loggerhead RMU was the only species in the ICCAT region with average susceptibility above 2.
- Productivity values identified
- Susceptibility: focus on horizontal overlap between s.t and fisheries analysed. Vertical overlap not considered (no available data)
- Susceptibility: in LL, Loggerhead had on average a BPUE that is 2-3 times higher than Green BPUE.
- RMU at highest risk from LL in the ICCAT area (Atlan+ Med) is Mediterranean Loggerhead

Angel, Nel, Wanless et al., 2013, SCRS

RMU	Productivity score	Rank
Cm-InSW	2.6	1
Ei-AtWCar	2.55	2
Cm-AtNW	2.45	3
Cc-AtNW	2.4	4
Cc-AtSW	2.3	5
Lk-AtNW	2.3	5
Dc-InSW	2.15	7
Cc-InSW	2.1	8
Cm-AtE	2.1	8
Lo-AtW	2.1	8
Ei-AtSW	2	11
Dc-AtSE	1.95	12
Cc-Med	1.75	13
Cm-AtSCar	1.7	14
Cm-AtSCen	1.7	14
Cm-AtSW	1.7	14
Cm-Med	1.7	14
Dc-AtNW	1.7	14
Lo-AtE	1.55	19
Cc-AtNE	1.5	20
Dc-AtSW	1.5	20
Ei-AtE	1.2	22

RMU	LL	Rank
Lo-AtE	2.47	1
Cm-AtSCar	2.39	2
Cc-Med	2.36	3
Dc-AtSW	2.12	4
Lk-AtNW	2.12	4
Cc-AtSW	2.12	4
Cm-AtNW	2.07	7
Ei-AtE	2.06	8
Ei-AtWCar	2.05	9
Dc-AtNW	1.98	10
Cc-AtNE	1.80	11
Cm-AtE	1.75	12
Dc-AtSE	1.45	13
Ei-AtSW	1.41	14
Cm-Med	1.39	15
Cm-AtSW	1.39	15
Cm-AtSCen	1.39	15
Lo-AtW	1.35	18
Cc-AtNW	1.17	19
Cm-InSW	1.08	20
Cc-InSW	1.03	21
Dc-InSW	0.99	22
Mean	1.72	

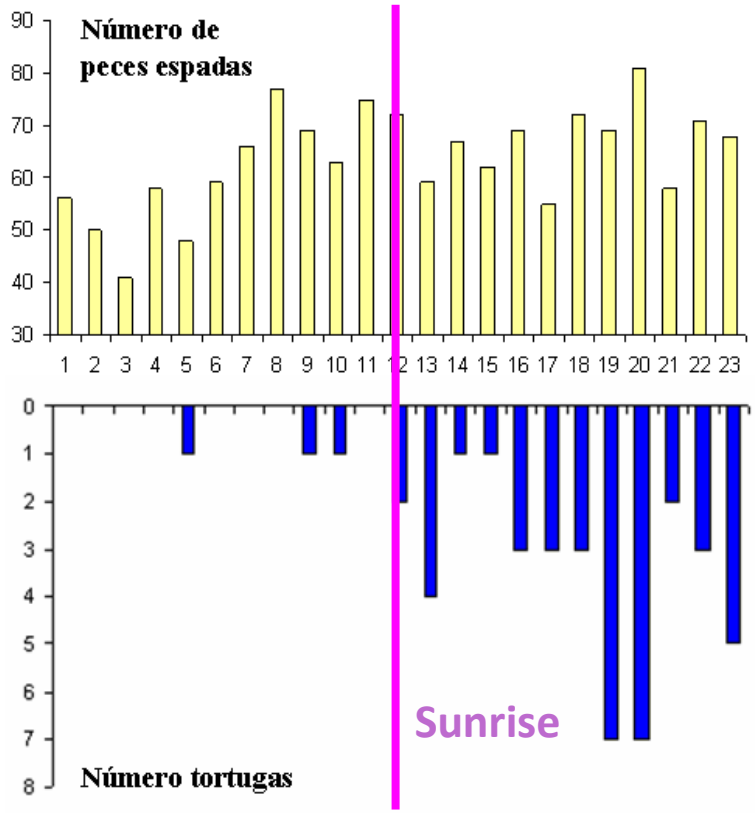
RMU	PS	Rank
Lo-AtE	2.09	1
Ei-AtE	1.87	2
Cc-AtNE	1.80	3
Dc-AtSW	1.80	3
Cm-AtSCar	1.64	5
Dc-AtNW	1.64	5
Dc-AtSE	1.45	7
Cm-AtSCen	1.39	8
Cm-AtSW	1.39	8
Dc-InSW	1.31	10
Cc-AtSW	1.22	11
Cc-AtNW	1.17	12
Cm-AtNW	1.14	13
Ei-AtWCar	1.10	14
Cm-AtE	1.03	15
Lo-AtW	1.03	15
Ei-AtSW	1.00	17
Mean	1.416	

Technical mitigation measures to reduce sea turtle bycatch and mortality

- Management measures to reduce fishing mortality of sea turtles are directed to:
  - Minimizing incidental interactions
  - Maximizing the number of sea turtles returned to the sea alive
  - Changes in gear structure and fishing strategies
- Operational and technological changes to gear to minimize interactions include:
  - Distant to the coast
  - Setting the gear during day or night
  - Type of hooks and combination with baits
- Additional measures focusing on:

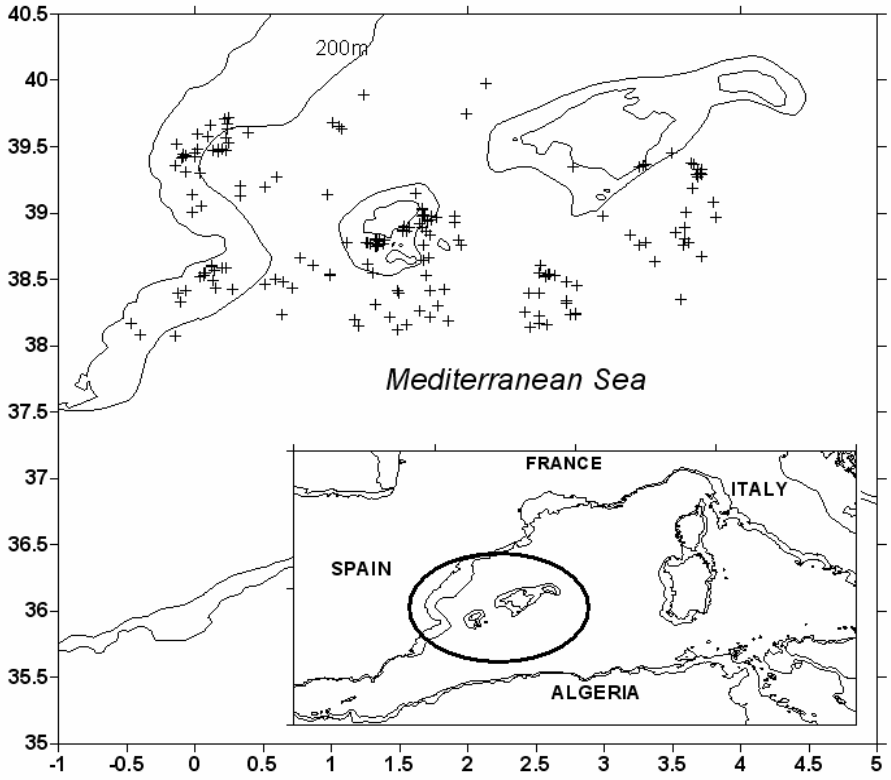
  i) education and awareness of fishermen;
  ii) generalize the use of mitigation tools on board fishing vessels
  iii) development of **handling/release guidelines fishery-specific**
  iv) promoting and reinforcing collaboration

J.C. BÁEZ, R. REAL & J.A. CAMIÑAS (2007). *Journal Marine Biological Association U.K.*, 87



Captures of Swordfish and Loggerhead by longline units (basket), day and night. Analyzed 59 standard operations in 23 baskets LLHB

J.C. BÁEZ, et al (2007). *Marine Ecology Progress Series,* 338: 249-256



Sea turtle by-catch dependency on distance to the coast independent of fishing effort
80 % of observed sets over 35 mn,
Results: 18% of total Swordfish and 65% of total Loggerhead

Main fishing strategies to reduce bycatch of sea turtle in surface longline fisheries

- Using circle hooks in place of J and Japan tuna hooks;
- Single hooking fish bait vs. multiple hook threading;
- Reducing gear soak time in surface LL
- Retrieval during daytime;
- Setting gear below turtle-abundant depths

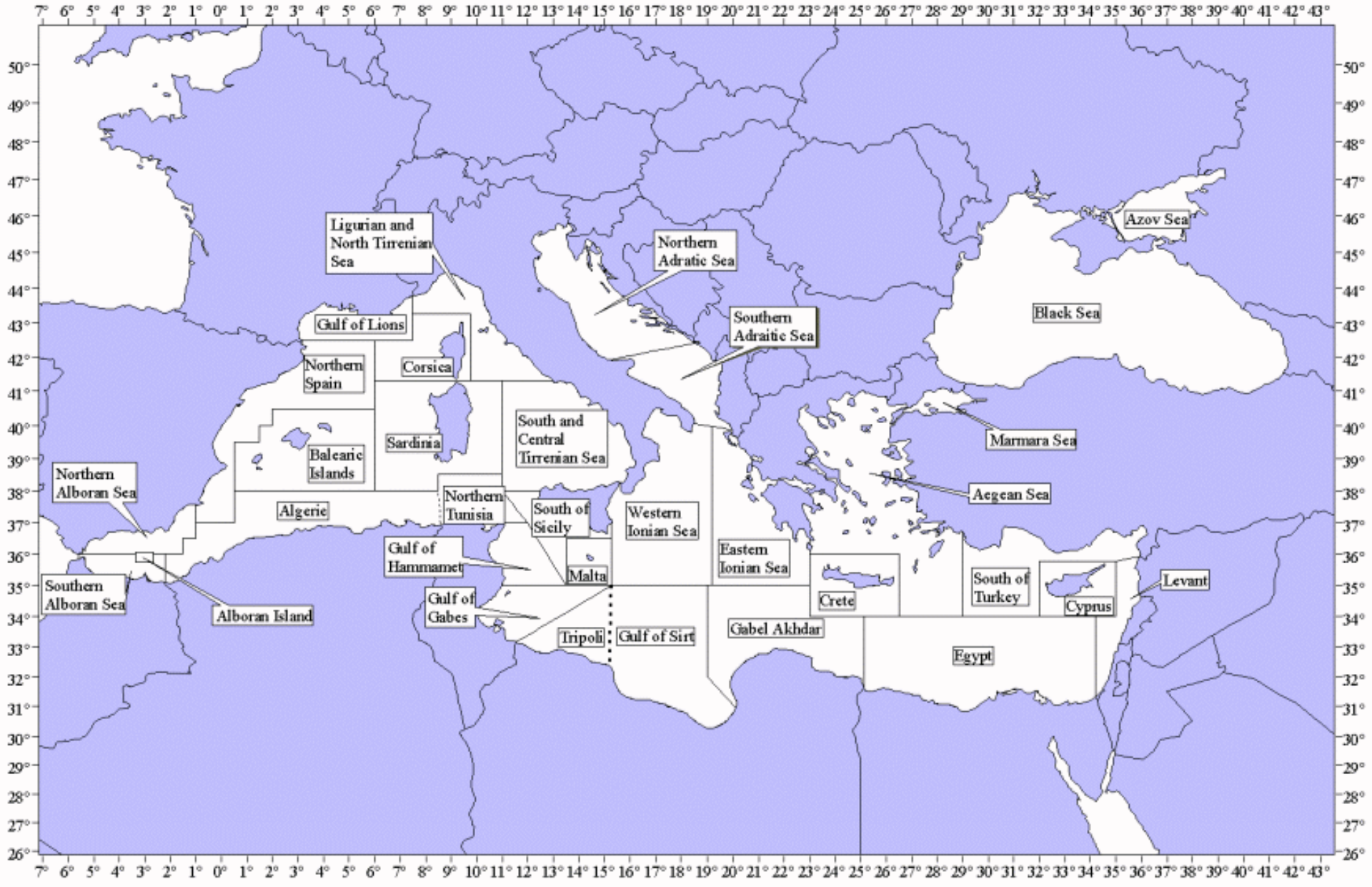
Problems to solve:

- Economic viability and operational implementation
- Each mitigation techniques may have either positive or negative effects on catch rates for other bycatch taxa or for target species

(Gilman et al., 2006; Gilman, M-Poulsen and Bianchi 2007. FAO & FAO 2014)

GFCM Mitigation Management Measures exist

Res 35-2011-7(d) Rec 35-2011-4 **DCRF (2014) Indicators**	Implementation of fisheries management measures that mitigate incidental taking and mortality of sea turtles
	Fishermen to promptly release unharmed sea turtles in any fishery
	Collect and provide the Commission with all data on bycatch and mortality of sea turtles
	Educate and train crews of vessels in techniques for safe handling turtles



GFCM Geographical subareas

Fisheries management

"The integrated process of information gathering, analysis, planning, consultation, decision-making, allocation of resources and formulation and implementation, with enforcement as necessary, of regulations or rules which govern fisheries activities in order to ensure the continued productivity of the resources and the accomplishment of other fisheries objectives". (FAO, 1997)

COMPLEX!

Fisheries activities and fisheries objectives need to be understood within the framework of EAF

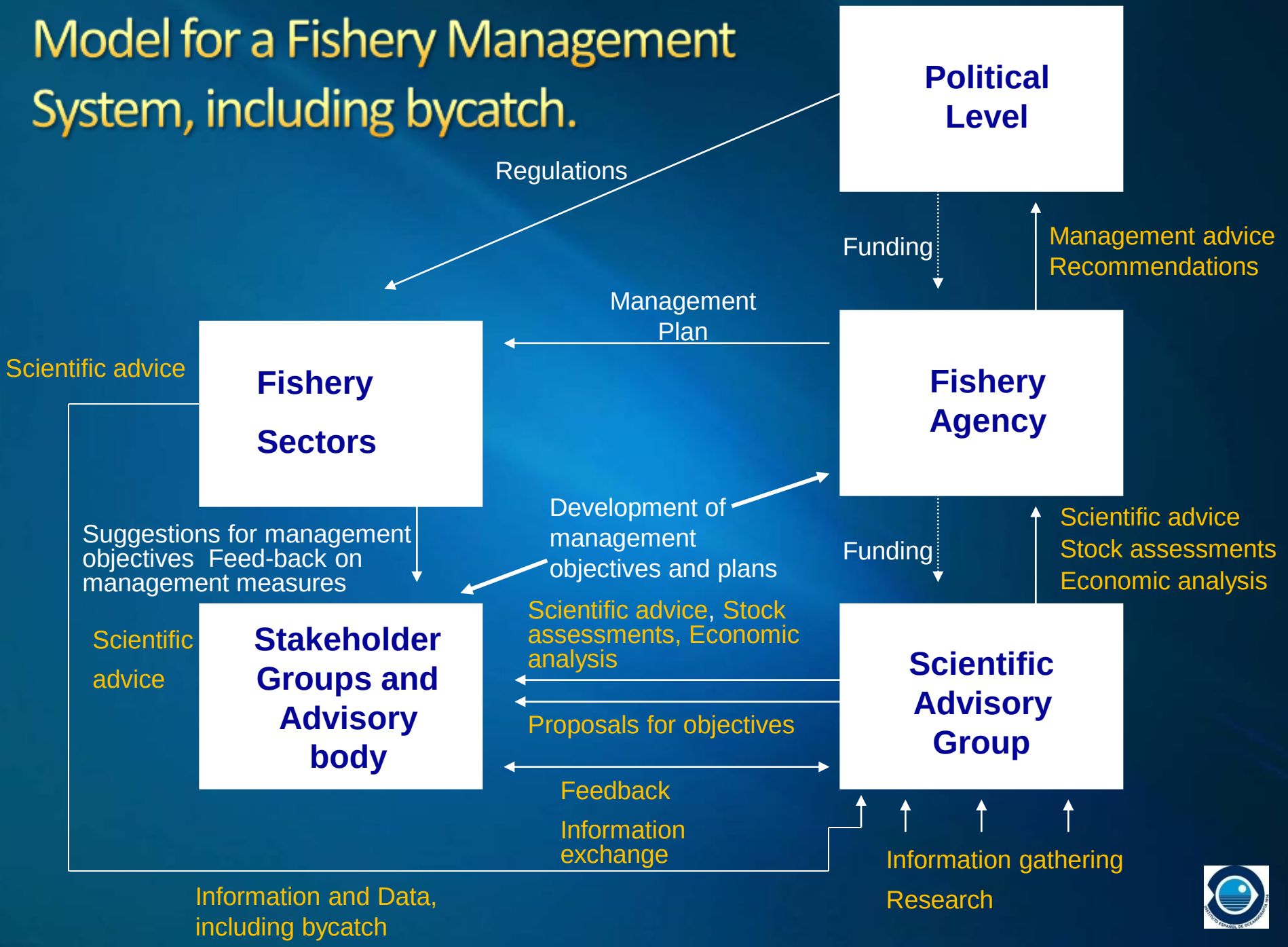
(A fishery managers' guidebook. Edited by Kevern L. Cochrane and Serge M. Garcia, 2009)

Fisheries management and management of turtle populations

Some questions:

- How do RFMO manage fisheries when affecting marine turtles? How are RFMOs managing turtle bycatch (GFCM, ICCAT, Pacific, other regions)?
- How are the experts involved in the fisheries management process?
- How do national and international non-fisheries organizations involved in management of turtles?

Model for a Fishery Management System, including bycatch.



GFCM involvement in bycatch

- Incorporating fisheries bycatch in Mediterranean fisheries management is of paramount importance.
- The non ICCAT fisheries/gears involved in bycatch in the Mediterranean (trawl nets, bottom nets, trammel nets, bottom longline, small scale fisheries, purse seine, etc.) must be of concern to GFCM and included in the current management of fisheries.
- SCMEE: revision status and bycatch.
- SAC: 2014 Recommendation on Data Collection to non target species including bycatch of sea turtles
- SAC (March 2015) agreed in create a platform to deal with bycatch and a WG on sea turtles by catch

Process: Incorporating fisheries bycatch of sea turtles in Mediterranean fisheries management needs the countries and experts involvement

Lessons learned from the Fisheries Management Organizations

- Data needs: fleets activity; fishing strategies; fishing gears, areas, data quality, etc. Improve poor data situations is urgent.
- Current data and scientific advise is incomplete. →Complete the Mediterranean picture.
- The ERA done by ICCAT- SCECO (poor data in different fisheries/regions) needs to be updated and improved for the Mediterranean fisheries.
- Marine turtles management within GFCM should take advantage of the existing MoU with other organizations.

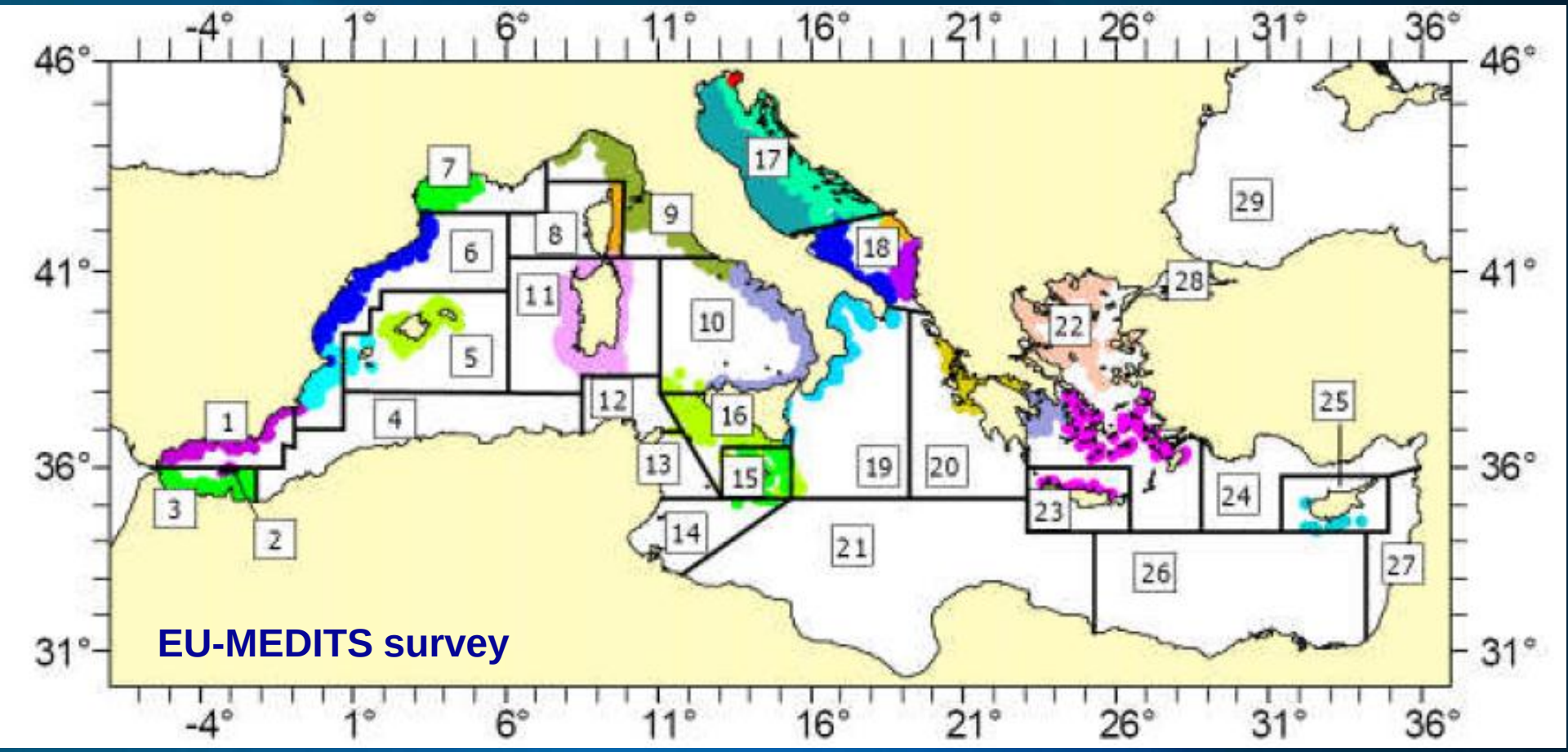
Proposal: Why not a MoU between GFCM and IUCN-Med MTSG?

Gaps in the process from science to sea turtle bycatch management

- Findings in scientific docs generally aren't available to managers nor translated to its administrative languages. The circuit scientific findings -> applied science is not always clear or completed.
- The level of implementation of measures to reduce bycatch is always low or inexistent.
- The social implications and economic costs generally not included in scientific proposals.
- Scientists (environmentalists, ecologists, fishery biologists, economists, sociologists, etc.) should assist the fishery administrations and sector during the whole management process to achieve concerted results to reduce bycatch.

How to address bycatch within GFCM?

- No single country, no single specialist can have the solution: Organization at country level is a priority.
- Fishing nations need to work together, looking at the bycatch issue across different species, fishing gears and countries (RFMO).
- Data series from national fisheries/Research Institutes, Universities and NGOs should be available
- Bycatch observers on board International and national surveys
- ERA could help guide RFMOs to determine priority bycatch issues, even in relatively poor data situations.
- Launch an ERA of Mediterranean fisheries affecting sea turtles
- Create a **Medturtle-bycatch database (MTByD)**, a database for collecting all sea turtle bycatch information and data in the Mediterranean basin



Source: EU MEDITS Programe

Key issues and Proposals

- Bycatch is a global threat that affects different taxa. The cumulative effects of different gears, periods and areas impacts at population-level needing a population-level approach
- Considering all species and oceans, surface longline bycatch of loggerhead in the Mediterranean is among the highest
- Bycatch of loggerhead in the Mediterranean affect mainly small turtles but fishing effort observed in trawl and longline fisheries are between the highest in the world
- The combination of high fishing effort and high susceptibility to bycatch mean cumulative high risk and greater conservation attention needs in Mediterranean
- Surface longline bycatch is only a part of the total bycatch. Joint efforts are needed to improve knowledge of overall bycatch of the Mediterranean Loggerhead and Green turtle populations including in small scale fisheries

Key issues and Proposals

- Despite the effort of RMFOs in implementing management measures for bycatch reduction of sea turtles the success is very limited. Improve information involving stakeholders.
- Scientist and stakeholders should improve their participation in the fisheries management of bycatch to improve sea turtle population status.
- The ERA in a PSA framework is a methodology to follow but the analysis in the Mediterranean region should incorporate all fisheries affecting sea turtles.
- Launch and ERA for Mediterranean fisheries affecting sea turtles
- Main gaps for assessment of populations (in terms of fisheries and populations parameters, susceptibility parameter, etc) needs to be filled through collaborative scientific efforts and improved regional coordination within RFMOs.
- The creation of a regional Mediterranean platform and a Medturtle-bycatch database for the implementation of bycatch regulations within SAC-GFCM is an opportunity to cooperate and update the analysis of the status and trends of Mediterranean RMUs within the GFCM framework.

"As scientists however, we do need to question whether we are making the most of our data, whether we are sharing it with policy and decision makers in a form that is comprehensive for their needs, and how we can encourage them to use these data to inform decisions. Having the data is only one step towards the conservation and sustainable use of marine species and habitats"

A. Broderick, 2015. Grand challenges in marine conservation and sustainable use. *Frontiers in Marine Science*, 2:11

Thank you very much