

```

use bycatch;
# Example of captured specimens count by haul and species
SELECT id_cala
, id_specie, count(id_specie)
FROM elasmobranchi_cattura ec
GROUP BY id_cala, id_specie
ORDER BY id_cala asc
LIMIT 0, 20000;

# Turtles
SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa ), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(tc.ID_Specie) as Specimens
FROM tartarughe_cattura tc
LEFT JOIN specie sp ON tc.ID_Specie = sp.id
LEFT JOIN operazioni_pesca op ON tc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE u.id_task = 1 AND g.name != 'GSA16'
GROUP BY tc.id_cala, tc.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000;

```

```

# Elasmobranchs
#Select * FROM elasmobranchi_cattura;
SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa ), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(ec.id_specie) as Specimens
FROM elasmobranchi_cattura ec
LEFT JOIN specie sp ON ec.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON ec.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id

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LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE u.id_task = 1
GROUP BY ec.id_cala, ec.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000;

# Dolphins
Select * FROM cetacei_cattura
ORDER BY id_cala;
SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa ), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(cc.id_specie) as Specimens
FROM cetacei_cattura cc
LEFT JOIN specie sp ON cc.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON cc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE g.name != "GSA16" and t.nome != 'Task5.1b' and l.nome != "Sciacca"
AND check_catch_real !=0
GROUP BY cc.id_cala, cc.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000;
#####
##### Aggregated by year #####
##### solo gsa 17 o NULL #####
#Turtles
SELECT Year, count(id_uscita) as Events,
specie,
sum(Specimens) as Specimens
FROM(
# Tartarughe
SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa ), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(tc.ID_Specie) as Specimens
FROM tartarughe_cattura tc
LEFT JOIN specie sp ON tc.ID_Specie = sp.id

```

```

LEFT JOIN operazioni_pesca op ON tc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE u.id_task = 1 and g.name!= "GSA16"
GROUP BY tc.id_cala, tc.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000
)as q1
GROUP BY Year, specie
LIMIT 0, 20000;

```

#Elasmobranchs

```

SELECT Year, count(id_uscita) as Events,
specie,
sum(Specimens) as Specimens
FROM(
SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(ec.id_specie) as Specimens
FROM elasmobranchi_cattura ec
LEFT JOIN specie sp ON ec.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON ec.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE u.id_task = 1 and g.name!= "GSA16"
GROUP BY ec.id_cala, ec.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000) as q1
GROUP BY Year, specie
LIMIT 0, 20000;

```

Dolphins

```

SELECT Year, count(id_uscita) as Events,
specie,
sum(Specimens) as Specimens
FROM(SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,

```

```
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa ), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(cc.id_specie) as Specimens
FROM cetacei_cattura cc
LEFT JOIN specie sp ON cc.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON cc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE g.name != "GSA16" and t.nome != 'Task5.1b' and l.nome != "Sciacca"
AND check_catch_real !=0
GROUP BY cc.id_cala, cc.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000
)
as q1
GROUP BY Year, specie
LIMIT 0, 20000;
```

```

use bycatch;
SELECT count(*) FROM cetacei_cattura; # sono 23, 2008-2019
SELECT count(*) FROM elasmobranchi_cattura; #8546 records
SELECT count(*) FROM tartarughe_cattura; #341

```

```
# Dolphins
```

```

SELECT * FROM cetacei_cattura ORDER BY datetime;
SELECT
l.nome as harbour,
YEAR(datetime) as Year,
MONTH(datetime) as Month,
sp.Nome_Scientifico,
#FishingTrips
#FishingHauls
#Duration
COUNT(cc.id) as BycatchEvents,
SUM(cc.n_tot_catture) as Individuals
#BycatchRate
#BPUE
FROM cetacei_cattura cc
LEFT JOIN specie sp ON cc.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON cc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
GROUP BY harbour, Year, Month, Nome_Scientifico
ORDER BY Year, MONTH;

```

```
#Fishing trips
```

```

SELECT datetime_partenza,
l.nome as harbour,
YEAR(u.datetime_partenza) as YEAR
FROM uscite u
LEFT JOIN localita l on u.Id_porto_partenza = l.id
WHERE u.id_task = 1# Task 5.1a
AND Id_porto_partenza IS NOT NULL
ORDER BY YEAR ASC
LIMIT 0, 20000;

```

```
#Task
```

```

SELECT DISTINCT(id_task), t.nome FROM uscite
LEFT JOIN task t ON uscite.id_task = t.id;

```

```
# Number of fishing trips and hauls per harbour, year and month
```

```

SELECT
CONCAT(l.nome, YEAR(u.datetime_partenza), MONTH(u.datetime_partenza) ) as id,
l.nome as harbour,
YEAR(u.datetime_partenza) as YEAR,
MONTH(u.datetime_partenza) as Month,
COUNT(DISTINCT(u.id)) as FishingTrips,
COUNT(op.id) as FishingHauls,
SUM(time_to_sec(TIMEDIFF(datetime_salpa, datetime_cala)))/3600 as Duration
FROM operazioni_pesca op
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
WHERE u.id_task = 1# Task 5.1a
GROUP BY YEAR, MONTH, harbour
ORDER BY YEAR
LIMIT 0, 20000;

```

```
##### All together: Dolphins #####
```

```

SELECT
C.harbour, C.Year, C.Month, C.Nome_Scientifico, C.BycatchEvents, Individuals, #from C
FishingTrips, FishingHauls, Duration,

```

```

# calcoli
BycatchEvents/FishingHauls AS BycatchRate,
Individuals/Duration AS BPUE
FROM
(SELECT
#id
concat(harbour, Year, Month) as id,
#tutto il resto
harbour, Year, Month, Nome_Scientifico,
count(id_cala) AS BycatchEvents, sum(Individuals) as Individuals FROM
(SELECT
l.nome as harbour, u.id_task,
YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as Month,
cc.id_cala, s.Nome_Scientifico,
COUNT(cc.id_cala) as Individuals
FROM cetacei_cattura cc
LEFT JOIN specie sp ON cc.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON cc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN specie s ON cc.id_specie= s.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
WHERE u.id_task = 1
GROUP BY id_cala, s.Nome_Scientifico
ORDER BY YEAR(datetime_cala), MONTH(datetime_cala),
l.nome, s.Nome_Scientifico) as A
GROUP BY YEAR, Month, harbour, Nome_Scientifico
LIMIT 0, 20000) AS C

LEFT JOIN

(SELECT
CONCAT(l.nome, YEAR(u.datetime_partenza), MONTH(u.datetime_partenza) ) as id,
l.nome as harbour,
YEAR(u.datetime_partenza) as YEAR,
MONTH(u.datetime_partenza) as Month,
COUNT(DISTINCT(u.id)) as FishingTrips,
COUNT(op.id) as FishingHauls,
SUM(time_to_sec(TIMEDIFF(datetime_salpa, datetime_cala)))/3600 as Duration
FROM operazioni_pesca op
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
WHERE u.id_task = 1# Task 5.1a
GROUP BY YEAR, MONTH, harbour
ORDER BY YEAR
LIMIT 0, 50000) AS D
ON C.id = D.id
LIMIT 0, 50000;

```

```

# Turtles
SELECT
C.harbour, C.Year, C.Month, C.Nome_Scientifico, C.BycatchEvents, Individuals, #from C
FishingTrips, FishingHauls, Duration,
# calcoli
BycatchEvents/FishingHauls AS BycatchRate,
Individuals/Duration AS BPUE
FROM
(SELECT
### id ###
CONCAT(harbour, Year, Month) as id,
### tutto il resto ###
harbour, Year, Month, Nome_Scientifico,
count(id_cala) AS BycatchEvents, sum(Individuals) as Individuals FROM
(SELECT

```

```

1.nome as harbour, u.id_task,
YEAR(u.datetime_partenza) as Year,
MONTH(u.datetime_partenza) as Month,
tc.id_cala, s.Nome_Scientifico,
COUNT(tc.id_cala) as Individuals
FROM tartarughe_cattura tc
LEFT JOIN specie sp ON tc.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON tc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN specie s ON tc.id_specie= s.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
WHERE u.id_task = 1# Task 5.1a
GROUP BY id_cala, Nome_Scientifico
ORDER BY YEAR(u.datetime_partenza), MONTH(u.datetime_partenza),
1.nome, s.Nome_Scientifico) as A
GROUP BY YEAR, Month, harbour, Nome_Scientifico
LIMIT 0, 20000) AS C

LEFT JOIN

(SELECT
CONCAT(1.nome, YEAR(u.datetime_partenza), MONTH(u.datetime_partenza) ) as id,
1.nome as harbour,
YEAR(u.datetime_partenza) as YEAR,
MONTH(u.datetime_partenza) as Month,
COUNT(DISTINCT(u.id)) as FishingTrips,
COUNT(op.id) as FishingHauls,
SUM(time_to_sec(TIMEDIFF(datetime_salpa, datetime_cala)))/3600 as Duration
FROM operazioni_pesca op
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
WHERE u.id_task = 1# Task 5.1a
GROUP BY YEAR, MONTH, harbour
ORDER BY YEAR
LIMIT 0, 50000) AS D
ON C.id = D.id
LIMIT 0, 50000;

```

Elasmobranchs

```

SELECT
  C.harbour, C.Year, C.Month, C.Nome_Scientifico, C.BycatchEvents, Individuals, #from C
  FishingTrips, FishingHauls, Duration,
# calcoli
BycatchEvents/FishingHauls AS BycatchRate,
Individuals/Duration AS BPUE
FROM
(SELECT
### id ###
CONCAT(harbour, Year, Month) as id,
### tutto il resto ###
harbour, Year, Month, Nome_Scientifico,
count(id_cala) AS BycatchEvents, sum(Individuals) as Individuals FROM
(SELECT
1.nome as harbour, u.id_task,
YEAR(u.datetime_partenza) as Year,
MONTH(u.datetime_partenza) as Month,
ec.id_cala, s.Nome_Scientifico,
COUNT(ec.id_cala) as Individuals
FROM elasmobranchi_cattura ec
LEFT JOIN specie sp ON ec.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON ec.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN specie s ON ec.id_specie= s.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
WHERE u.id_task = 1

```

```

GROUP BY id_cala, Nome_Scientifico
ORDER BY YEAR(u.datetime_partenza), MONTH(u.datetime_partenza),
l.nome, s.Nome_Scientifico) as A
GROUP BY YEAR, Month, harbour, Nome_Scientifico
LIMIT 0, 20000) AS C

```

```
LEFT JOIN
```

```

(SELECT
CONCAT(l.nome, YEAR(u.datetime_partenza), MONTH(u.datetime_partenza) ) as id,
l.nome as harbour,
YEAR(u.datetime_partenza) as YEAR,
MONTH(u.datetime_partenza) as Month,
COUNT(DISTINCT(u.id)) as FishingTrips,
COUNT(op.id) as FishingHauls,
SUM(time_to_sec(TIMEDIFF(datetime_salpa, datetime_cala)))/3600 as Duration
FROM operazioni_pesca op
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
WHERE u.id_task = 1# Task 5.1a
GROUP BY YEAR, MONTH, harbour
ORDER BY YEAR
LIMIT 0, 50000) AS D
ON C.id = D.id
LIMIT 0, 50000;

```

Accuracy Test - Observe individuals by port, year and month in a random Harbour/species combination

```

SELECT
l.nome as harbour, u.id_task,
YEAR(u.datetime_partenza) as Year,
MONTH(u.datetime_partenza) as Month,
s.Nome_Scientifico, ec.id_animale as Identificativo,
ec.id_cala as Cala
#count(ec.id_cala) as Individui #####
FROM elasmobranchi_cattura ec
LEFT JOIN specie sp ON ec.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON ec.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN specie s ON ec.id_specie= s.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
WHERE u.id_task = 1 AND
l.nome = "Chioggia" AND
s.Nome_Scientifico = 'Mustelus punctulatus' AND
YEAR(u.datetime_partenza) = 2018 AND
MONTH(u.datetime_partenza) = 5
#GROUP BY ec.id_cala #####
ORDER BY YEAR(u.datetime_partenza), MONTH(u.datetime_partenza)

LIMIT 0, 3000;

SELECT * FROM elasmobranchi_cattura;

```



```
#Morphometric data tables
```

```
# Remember "Task"
```

```
use bycatch;
```

```
SELECT * FROM tartarughe_cattura;
```

```
# Tartarughe
```

```
SELECT tc.id_cala as id_cala,
```

```
s.Nome_Scientifico as Specie,
```

```
g.name as GSA,
```

```
l.nome as harbour,
```

```
cc.nome as Condizioni_Cattura,
```

```
gb.nome as Rilascio,
```

```
cr.nome as Condizioni_Rilascio,
```

```
CCLM_Lungh,
```

```
CCLM_Largh,
```

```
CSLM_Lungh,
```

```
CSLM_Largh,
```

```
Peso_KG,
```

```
cs.nome_abbr as Sesso
```

```
FROM tartarughe_cattura tc
```

```
LEFT JOIN operazioni_pesca op ON tc.id_cala = op.id
```

```
LEFT JOIN gsa g ON op.gsa_salpa = g.id
```

```
LEFT JOIN uscite u ON op.id_uscita = u.id
```

```
LEFT JOIN localita l on u.Id_porto_partenza = l.id
```

```
LEFT JOIN task t ON u.id_task = t.id
```

```
LEFT JOIN specie s ON tc.ID_Specie = s.id
```

```
LEFT JOIN cattura_condizioni cc ON tc.id_Condizioni_Cattura = cc.id
```

```
LEFT JOIN gen_bool gb ON tc.Rilascio = gb.id
```

```
LEFT JOIN tartarughe_rilascio tr ON tc.id = tr.id_cattura
```

```
LEFT JOIN cattura_condizioni cr ON tr.id_condizioni = cr.id
```

```
#LEFT JOIN cattura_rilascio cr ON tc.Rilascio = cr.id
```

```
LEFT JOIN cattura_sex cs ON tc.ID_Sesso = cs.id
```

```
WHERE g.name != "GSA16" and t.nome != 'Task5.1b' and l.nome != "Sciacca"
```

```
LIMIT 0, 50000;
```

```
# Elasmobranchs
```

```
SELECT * FROM elasmobranchi_cattura;
```

```
SELECT
```

```
op.id_uscita as id_uscita,
```

```
op.id as id_cala,
```

```
g.name as gsa,
```

```
l.nome as harbour,
```

```
v.nome as Vessel,
```

```
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
```

```
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
```

```
op.COG_Cala as route,
```

```
op.Lat_Cala, op.Lon_Cala,
```

```
op.Lat_Salpa, op.Lon_Salpa,
```

```
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
```

```
timestampdiff(minute, op.datetime_cala, op.datetime_salpa) as duration,
```

```
b.scale as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
```

```
op.mitigazione, # da vedere con Sara
```

```
sp.Nome_scientifico as specie,
```

```
cs.nome as sesso,
```

```
mat.livello as maturità,
```

```
Squali_Lunghezza_cm,
```

```
Razze_DW_cm,
```

```
peso_kg,
```

```
#count(ec.id_specie) as Specimens #non li contiamo più per specie e per cala
```

```
id_gen,
```

```
id_iso1,
```

```
id_iso2,
```

```
id_tag,
```

```
cc.nome as Condizioni_Cattura,
```

```
cr.nome as Rilascio
```

```

FROM elasmobranchi_cattura ec
LEFT JOIN specie sp ON ec.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON ec.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l ON u.Id_porto_partenza = l.id
LEFT JOIN task ON u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
LEFT JOIN cattura_sex cs ON ec.Id_Sesso = cs.id
LEFT JOIN maturita mat ON ec.id_maturita = mat.id
LEFT JOIN cattura_condizioni cc ON ec.id_stato_cattura = cc.id
LEFT JOIN cattura_condizioni cr ON ec.id_stato_rilascio = cr.id
WHERE u.id_task = 1 and g.name != "GSA16" and l.nome != "Schiacca"
#GROUP BY ec.id_cala, ec.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000;

```

```
# Dolphins
```

```
use bycatch;
```

```
SELECT * FROM cetacei_cattura;
```

```

SELECT op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
s.Nome_Scientifico as Specie,
cs.nome_abbr as Sesso,
cc.nome as Condizioni_Cattura,
cr.nome as Rilascio,
lungh_tot_cm
FROM cetacei_cattura tc
LEFT JOIN operazioni_pesca op ON tc.id_cala = op.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l ON u.Id_porto_partenza = l.id
LEFT JOIN task t ON u.id_task = t.id
LEFT JOIN specie s ON tc.ID_Specie = s.id
LEFT JOIN cattura_condizioni cc ON tc.id_condizione_cattura = cc.id
LEFT JOIN cattura_condizioni cr ON tc.id_condizione_rilascio = cr.id
LEFT JOIN cattura_sex cs ON tc.id_sesso = cs.id
WHERE g.name != "GSA16" and t.nome != 'Task5.1b' and l.nome != "Schiacca"
AND check_catch_real !=0
LIMIT 0, 50000;

```

```
# Dolphin sightings #####
```

```

SELECT
op.id_uscita as id_uscita,
av.id_cala as haul,
DATE(op.datetime_cala) as date,
YEAR(op.datetime_cala) as Year,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
s.Nome_Scientifico as species,

```

```
av.N_quantita as Specimens,  
op.Pos_Oss_alla_Salpa_Prua,  
op.Pos_Oss_alla_Salpa_Traverso,  
op.Pos_Oss_alla_Salpa_Poppa,  
op.Pos_Oss_alla_Salpa_Tuga,  
d.distanza_m as distance,  
gcs.nome as behaviour  
FROM avvistamenti av  
# informazioni di cala, uscita, porto, gsa  
LEFT JOIN operazioni_pesca op ON av.id_cala = op.id  
LEFT JOIN uscite u ON op.id_uscita = u.id  
LEFT JOIN gsa g ON op.gsa_salpa = g.id  
LEFT JOIN localita l on u.Id_porto_partenza = l.id  
LEFT JOIN task t on u.id_task = t.id  
# altre info  
LEFT JOIN specie s ON av.id_specie = s.id  
LEFT JOIN distanze d ON av.id_distanza = d.id  
LEFT JOIN gen_comport_di_superficie gcs ON av.comport_di_superficie= gcs.id  
WHERE g.name != "GSA16" and t.nome != 'Task5.1b' and l.nome != "Sciacca"  
ORDER BY Date(op.datetime_cala)  
LIMIT 0, 20000;
```

```
##### Example of data extraction and maps creation #####
```

```
# Load packages ####
```

```
library("tidyverse")
library("rfishbase")
library("RMySQL")
library("rgdal")
library("rgeos")
library("geosphere")
library("raster")
library("reshape2")
library("ggplot2")
library("lubridate")
library("gridExtra")
library("sp")
library("sf")
library("viridis")
library("RColorBrewer")
```

```
# Dataset extraction ####
```

```
sql_fun = function(query){
  conn <- dbConnect(MySQL()),
  user="xxxxxxxxxx",
  password="xxxxxxxxxx",
  dbname="bycatch",
  host="xxxxxxxxxx")
  df = dbGetQuery(conn, query)
  # dbDisconnect(conn)
  lapply(dbListConnections(MySQL()), dbDisconnect)
  df
}
```

```
# Fishing effort
```

```
q_hauls ="SELECT
t.nome as task,
u.id as id_uscita,
op.id as id_cala,
YEAR(datetime_cala) as Year,
DATE(datetime_cala) as date,
g.name as GSA,
l.nome as harbour,
v.nome as vessel,
Lat_Cala, Lon_Cala,
Lat_salpa, Lon_salpa,
(Prof_Cala_m + Prof_Salpa_m)/2 as mean_depth,
Velocita_Traina_nm_h as speed,
TIME(op.datetime_cala) as datetime_cala,
TIME(op.datetime_salpa ) as datetime_salpa
FROM operazioni_pesca op
LEFT JOIN uscite u
ON op.id_uscita = u.id
LEFT JOIN gsa g
ON op.gsa_salpa = g.id
LEFT JOIN vessel v
ON u.id_vessel_principale = v.id
LEFT JOIN localita l ON
u.Id_porto_partenza = l.id
LEFT JOIN task t
ON u.id_task = t.id
WHERE g.name != 'GSA16' and t.nome != 'Task5.1b'
ORDER BY Year
LIMIT 0, 50000;"
```

```
cale = sql_fun(q_hauls)
cale = cale[which(cale$Lon_Cala != 0),]
```

```
cale = cale[!is.na(cale$Lat_Cala) & cale$Lat_Cala > 0,]
```

```

cale = cale[!is.na(cale$Lat_salpa) & cale$Lat_salpa > 0,]
# calculate haul midpoints - geosphere::midPoint()
pp = midPoint(SpatialPoints(cale[,c("Lon_Cala", "Lat_Cala")]),
              SpatialPoints(cale[,c("Lon_Cala", "Lat_salpa")]))
cale$lon = pp[,1]
cale$lat = pp[,2]
colnames(cale)[13]<- "depth"

```

Marine turtles

```

q_tarta = "SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa ), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(tc.ID_Specie) as Specimens
FROM tartarughe_cattura tc
LEFT JOIN specie sp ON tc.ID_Specie = sp.id
LEFT JOIN operazioni_pesca op ON tc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE u.id_task = 1 AND g.name != 'GSA16'
GROUP BY tc.id_cala, tc.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000;"
tarta = sql_fun(q_tarta)
tarta = dcast(tarta, id_cala ~ specie, fun.aggregate = sum, value.var = "Specimens")
colnames(tarta)[2:ncol(tarta)] <- gsub(" ", "_", colnames(tarta)[2:ncol(tarta)])

```

Elasmobranchs

```

q_elasmo = "#Select * FROM elasmobranchi_cattura;
SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa ), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(ec.id_specie) as Specimens
FROM elasmobranchi_cattura ec
LEFT JOIN specie sp ON ec.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON ec.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id

```

```
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
WHERE u.id_task = 1 AND g.name != 'GSA16'
GROUP BY ec.id_cala, ec.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000;"
elasma = sql_fun(q_elasma)
elasma = dcast(elasma, id_cala ~ specie, fun.aggregate = sum, value.var = "Specimens")
colnames(elasma)[2:ncol(elasma)] <- gsub(" ", "_", colnames(elasma)[2:ncol(elasma)])
```

Dolphins

```
q_delfi = "SELECT
op.id_uscita as id_uscita,
op.id as id_cala,
g.name as gsa,
l.nome as harbour,
v.nome as Vessel,
Date(datetime_cala) as Date, YEAR(datetime_cala) as Year,
MONTH(datetime_cala) as month, TIME(datetime_cala) as Time,
op.COG_Cala as route,
op.Lat_Cala, op.Lon_Cala,
op.Lat_Salpa, op.Lon_Salpa,
op.Velocita_Traina_nm_h as speed, op.Prof_Cala_m as depth,
TIMEDIFF(TIME(op.datetime_salpa), TIME(op.datetime_cala)) as duration,
b.scala as beaufort_scale, b.velocita_vento_nds as velocita_vento_nds,
op.mitigazione, # da vedere con Sara
sp.Nome_scientifico as specie, count(cc.id_specie) as Specimens
FROM cetacei_cattura cc
LEFT JOIN specie sp ON cc.id_specie = sp.id
LEFT JOIN operazioni_pesca op ON cc.id_cala = op.id
LEFT JOIN uscite u ON op.id_uscita = u.id
LEFT JOIN localita l on u.Id_porto_partenza = l.id
LEFT JOIN task on u.id_task = task.id
LEFT JOIN vessel v ON u.id_vessel_principale = v.id
LEFT JOIN gsa g ON op.gsa_salpa = g.id
LEFT JOIN beaufort b ON op.id_beaufort_cala = b.id
LEFT JOIN task t on u.id_task= t.id
WHERE g.name != 'GSA16' and t.nome != 'Task5.1b' and l.nome !='Sciacca'
AND check_catch_real !=0
GROUP BY cc.id_cala, cc.id_specie
ORDER BY Date(datetime_cala)
LIMIT 0, 20000;"
```

```
delfi = sql_fun(q_delfi)
delfi = dcast(delfi, id_cala ~ specie, fun.aggregate = sum, value.var = "Specimens")
colnames(delfi)[2:ncol(delfi)] <- gsub(" ", "_", colnames(delfi)[2:ncol(delfi)])
```

Create a unique dataset:

```
ydat = merge(merge(merge(cafe, elasma, by = "id_cala", all.x = T),
  tarta, by = "id_cala",all.x = T), delfi, by = "id_cala",all.x = T)
```

```
colnames(ydat)[4]<- "year"
ydat$quarter = quarter(ydat$date)
ydat$month = month(ydat$date)
```

Variables selection:

```
ydat<- ydat[, c("id_cala", "year", "quarter", "month", "datetime_cala", "lon", "lat", "depth",
"(ND)_RAJIFORME", "(ND)_SQUALIFORME",
"Aetomylaeus_bovinus", "Alopias_vulpinus",
"Carcharhinus_plumbeus", "Dasyatis_pastinaca",
"Mustelus_asterias", "Mustelus_mustelus",
"Mustelus_punctulatus", "Mustelus_spp",
"Myliobatis_aquila", "Prionace_glauca",
"Pteroplatytrygon_violacea", "Raja_asterias",
"Raja_clavata", "Raja_miraletus",
"Scyliorhinus_canicula", "Scyliorhinus_stellaris",
```

```
"Squalus_acanthias",      "Torpedo_marmorata",
"(ND)_TARTARUGA",
"Caretta_caretta",       "Tursiops_truncatus"]]
```

Save:

```
saveRDS(ydat, "xxxxxx/results/ydat.rData")
```

Load grid - a SpatialPolygonDataFrame

```
wgs = "+proj=longlat +datum=WGS84 +no_defs +ellps=WGS84 +towgs84=0,0,0"
grid = readOGR("xxxxxx/grid_base_5nm.shp")
proj4string(grid) = wgs
grid@data = data.frame(id_cell = grid@data$id)
xcent = gCentroid(grid, byid = T)
grid@data$lon = xcent@coords[,1]
grid@data$lat = xcent@coords[,2]
colnames(grid@data) = c("ID_CELL", "LON", "LAT")
```

Maps - Datasets preparation #####**#dolphins**

```
dolphins<- ydat %>% dplyr::select(c(ID_CELL,id_cala, year, lon, lat, Tursiops_truncatus))
dolphins[is.na(dolphins)] <- 0
dolphins<- dolphins%>% dplyr::select(ID_CELL, Tursiops_truncatus) %>%
  group_by(ID_CELL) %>% summarize(dolphins= sum(Tursiops_truncatus))
grid_dolphins = grid
grid_dolphins = sp::merge(grid_dolphins, dolphins, by = "ID_CELL", all.x = T)
grid_dolphins@data[is.na(grid_dolphins@data)] <- 0
```

#sharks

```
sharks<- ydat[,c("ID_CELL", "id_cala", "year", "lon", "lat", "(ND)_SQUALIFORME",
"Alopias_vulpinus", "Carcharhinus_plumbeus", "Mustelus_asterias",
"Mustelus_mustelus",
"Mustelus_punctulatus", "Mustelus_spp", "Prionace_glauca", "Scyliorhinus_canicula",
"Scyliorhinus_stellaris", "Squalus_acanthias")]
sharks[is.na(sharks)] <- 0
sharks<- melt(sharks, id.vars = c("ID_CELL", "id_cala", "year", "lon", "lat"))
sharks<- sharks%>% dplyr::select(ID_CELL, value) %>%
  group_by(ID_CELL) %>% summarize(sharks= sum(value))
grid_sharks = grid
grid_sharks = sp::merge(grid_sharks, sharks, by = "ID_CELL", all.x = T)
grid_sharks@data[is.na(grid_sharks@data)] <- 0
```

```
batoids<- ydat[,c("ID_CELL", "id_cala", "year", "lon", "lat",
"(ND)_RAJIFORME", "Aetomylaeus_bovinus", "Dasyatis_pastinaca",
"Myliobatis_aquila", "Pteroplatytrygon_violacea", "Raja_asterias",
"Raja_clavata", "Raja_miraletus", "Torpedo_marmorata" )]
batoids[is.na(batoids)] <- 0
batoids<- melt(batoids, id.vars = c("ID_CELL", "id_cala", "year", "lon", "lat"))
batoids<- batoids%>% dplyr::select(ID_CELL, value) %>%
  group_by(ID_CELL) %>% summarize(batoids= sum(value))
grid_batoids = grid
grid_batoids = sp::merge(grid_batoids, batoids, by = "ID_CELL", all.x = T)
grid_batoids@data[is.na(grid_batoids@data)] <- 0
```

```
turtles<- ydat[, c("ID_CELL", "id_cala", "year", "lon", "lat", "(ND)_TARTARUGA",
"Caretta_caretta")]
turtles[is.na(turtles)] <- 0
turtles<- melt(turtles, id.vars = c("ID_CELL", "id_cala", "year", "lon", "lat"))
turtles<- turtles%>% dplyr::select(ID_CELL, value) %>%
  group_by(ID_CELL) %>% summarize(turtles= sum(value))
grid_turtles = grid
grid_turtles = sp::merge(grid_turtles, turtles, by = "ID_CELL", all.x = T)
grid_turtles@data[is.na(grid_turtles@data)] <- 0
```

```
#Spatial grids: ####
```

```
# 1) grid_dolphins
# 2) grid_sharks
# 3) grid_batoids
# 4) grid_turtles
```

```
gd<- st_as_sf(grid_dolphins)
gs<- st_as_sf(grid_sharks)
gb<- st_as_sf(grid_batoids)
gt<- st_as_sf(grid_turtles)
```

```
# Plots ####
```

```
#dolphins
```

```
dolphins_mycol<- c("#FFFFFF", sf.colors(2))
range(gd$dolphins)
dp_values<- c(0,1,2)
dp_vec<- findInterval(gd$dolphins, dp_values, left.open = T)
dp_vec<- dp_vec+1
dp_Intervals<- c("0","1","2")
dpSpecimens<- dp_Intervals[dp_vec]
dpSpecimens<- factor(dpSpecimens, levels = c("0","1","2"))
gd$Specimens<- dpSpecimens
dp<- ggplot(gd) + geom_sf(aes(fill=Specimens), colour =NA) +
  geom_sf(data = Map1, fill = "gray", colour= "grey25")+
  xlim(c(12,16)) + ylim(c(42,46))+
  scale_fill_manual(values = dolphins_mycol, name= "Specimens") +
  ggtitle("Dolphins") +
  theme(plot.title = element_text( face = "bold"))
```

```
#sharks
```

```
sharks_mycol<- c("#FFFFFF", sf.colors(9))
range(gs$sharks)
sp_values<- c(0,10,20,30, 40,50, 100, 150, 200, 250)
sharks_vec<- findInterval(gs$sharks, sp_values, left.open = T)
sharks_vec<- sharks_vec+1
sk_Intervals<- c("0", "1-10", "10-20", "20-30", "30-40",
  "40-50", "50-100", "100-150", "150-200", ">200")
skSpecimens<- sk_Intervals[sharks_vec]
skSpecimens<- factor(skSpecimens, levels = c("0", "1-10", "10-20", "20-30", "30-40",
  "40-50", "50-100", "100-150", "150-200", ">200"))
gs$Specimens<- skSpecimens
```

```
#plot
```

```
sp<- ggplot(gs) + geom_sf(aes(fill=Specimens), colour=NA) +
  geom_sf(data = Map1, fill = "gray", colour= "grey25")+
  xlim(c(12,16)) + ylim(c(42,46)) +
  scale_fill_manual(values = sharks_mycol, name= "Specimens") +
  ggtitle("Sharks") +
  theme(plot.title = element_text( face = "bold"))
```

```
#batoids
```

```
batoids_mycol<- c("#FFFFFF", sf.colors(9))
range(gb$batoids)
bp_values<- c(0,10,20,30, 40,50, 100, 150, 200)
batoids_vec<- findInterval(gb$batoids, bp_values, left.open = T)
batoids_vec<- batoids_vec+1
bat_Intervals<- c("0", "1-10", "10-20", "20-30", "30-40",
  "40-50", "50-100", "100-150", "150-200")
batSpecimens<- bat_Intervals[batoids_vec]
batSpecimens<- factor(batSpecimens, levels = c("0", "1-10", "10-20", "20-30", "30-40",
  "40-50", "50-100", "100-150", "150-200"))
gb$Specimens<- batSpecimens
```

```
#plot
```

```
bp<- ggplot(gb) + geom_sf(aes(fill=Specimens), colour= NA) +
```



```
geom_sf(data = Map1, fill = "gray", colour= "grey25")+  
xlim(c(12,16)) + ylim(c(42,46)) +  
scale_fill_manual(values = batoids_mycol, name= "Specimens") +  
ggtitle("Skates and rays") +  
theme(plot.title = element_text( face = "bold"))
```

```
#turtles  
mycol<- c("#FFFFFF", sf.colors(5))  
range(gt$turtles)  
tp_values<- c(0,5,10,20,30,40,50,60,70)  
i_vec<- findInterval(gt$turtles, tp_values, left.open = T)  
i_vec<- i_vec+1  
Intervals<- c("0", "1-5", "5-10", "10-20", "20-30", "30-40", "40-50", "50-60", "60-70")  
Specimens<- Intervals[i_vec]  
Specimens<- factor(Specimens, levels = c("0", "1-5", "5-10", "10-20", "20-30", "30-40", "40-50",  
"50-60", "60-70"))  
gt$Interval<- Interval  
#plot  
tp<- ggplot(gt) + geom_sf(aes(fill=Specimens), colour=NA) +  
geom_sf(data = Map1, fill = "gray", colour= "grey25")+  
xlim(c(12,16)) + ylim(c(42,46)) +  
scale_fill_manual(values = mycol, name= "Specimens") +  
ggtitle("Sea turtles") +  
theme(plot.title = element_text( face = "bold"))
```

```
# Full plot  
grid.arrange(dp, tp, sp, bp, ncol=2)
```