

2016 New year Symposium on Marine Litter

Current condition of marine litter around Japan. 日本周辺における漂流ごみの現状

Keiichi Uchida

with

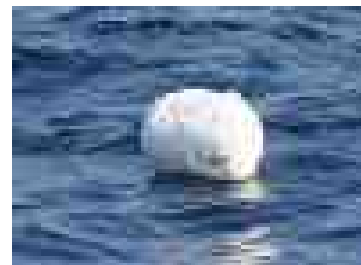
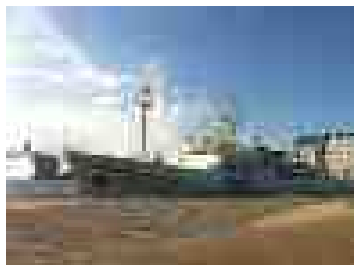
Tokai Tadashi

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Tokyo University of Marine Science and Technology.



Introduction はじめに

The Act on Promotion of Disposal of Articles Washed Ashore for Conservation of Good Coastal Views and Environment for Conserving Beautiful Rich Nature (Act No. 82 of 2009; Washed-Ashore Articles Disposal Promotion Act)

美しく豊かな自然を保護するための海岸における良好な景観及び環境の保全に係る海岸漂着物等の処理等の推進に関する法律
(2009年7月成立)

Where are from these marine debris.

Shore: many data from NPO
Approach is **easy**

Off Shore : few data
Approach is **difficult**



Platform 調査船

Training and research vessel



Gross ton 1886[t] , length 93.0[m] ,
wide 14.90[m] , depth 8.90[m]
Nav. speed 17.4[kt]
Number of bed 107 (crew:47,cadet:60)
Build 30th June 2000

Cover area
Pacific ocean , Indian ocean,
Antarctic ocean etc.

Eye height of observer: 14m



Grosston 649[t], length 53.0[m],
Wide 110.6[m], Depth 6.8[m]
Nav. speed 13.0[kt]
Number of bed 69 (crew:25,cadet:44)
Build 10th Dec.1983

Cover area
Northern west of Pacific

Eye height of observer: 7m

Observation system



Visual observation

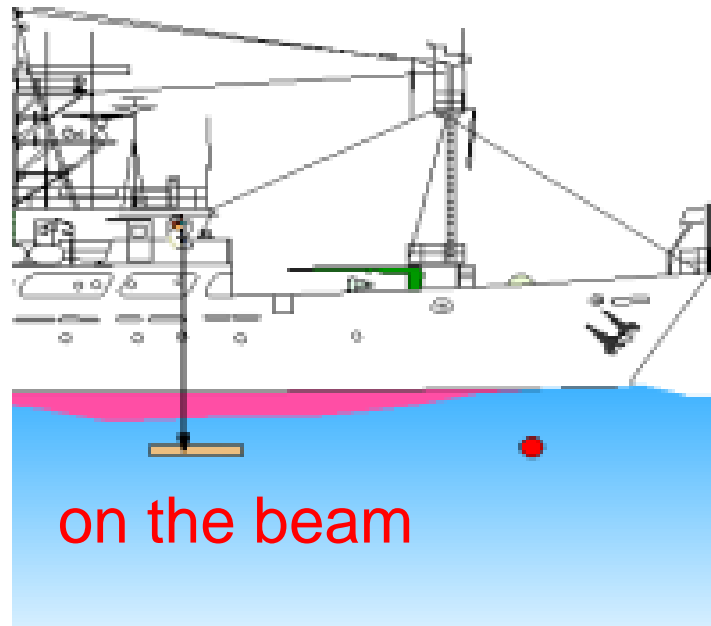


Trawl sampling



Net sampling

Observation method 調査方法



Recorded info.

- name of item (color, size)
- Distance of Closest Approach (DCA)
- Environment etc.

Observation system
recorder 1 p, researcher 3 or 4



Distance of closest approach
(DCA) was measured every 5
meters from ship of side by
visual measurement.

How to measure a Distance of Closest Approach

最接近距離の計測方法

To acquire a sense of distance by using the inclinometer

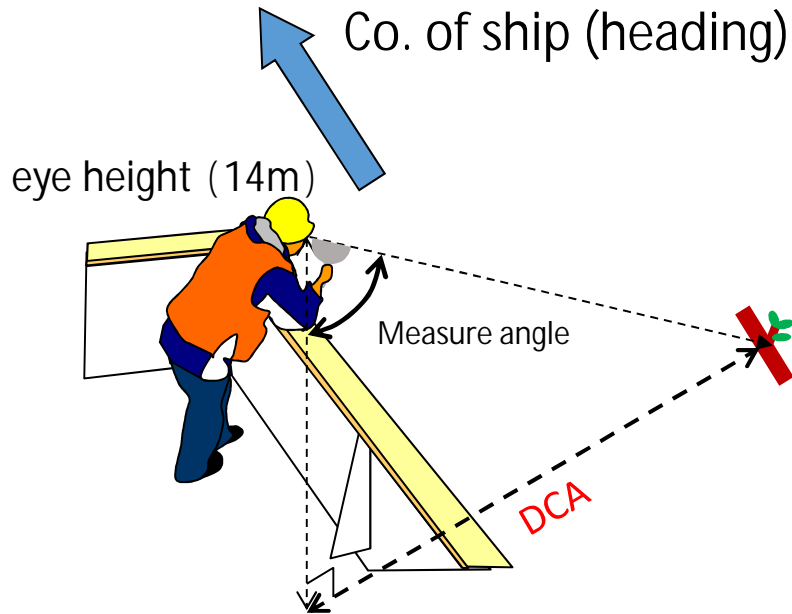
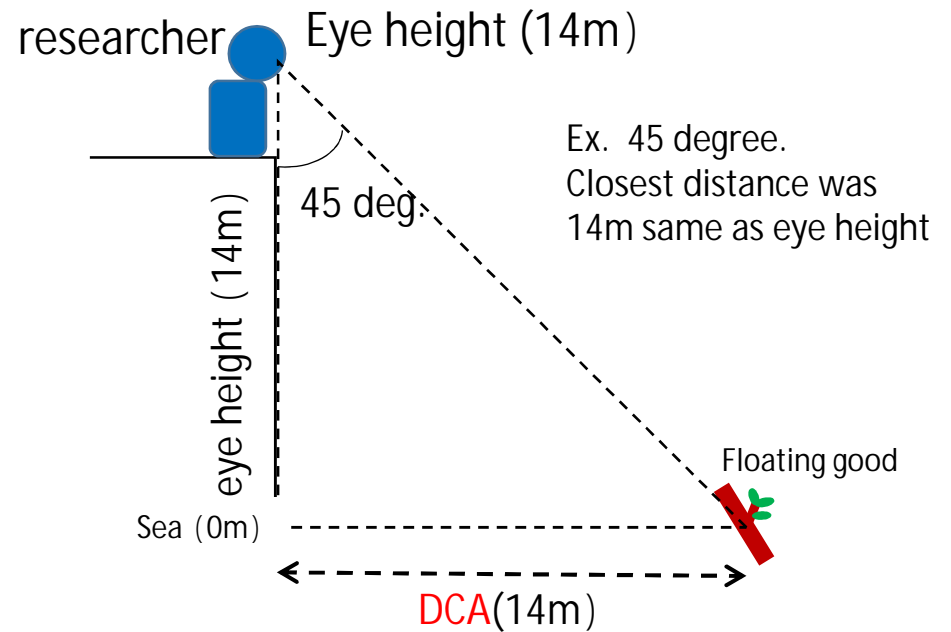


Image of measurement distance



Relation between angel and DCA

Angle deg.	5	10	15	20	25	30	35	40	45	50	55	60	65	70	75	80	85
Eye height (m)	1.2	2.5	3.8	5.1	6.5	8.1	9.8	11.7	14	17	20	24	30	38	52	79	160

Sample sheet

To reduce a personal error for size

記録用早見表

サイズの記入はSLMで

サイズの記入例

20cm > SS

カップめんの容器,
ソフトボール, 落ち葉,
空き缶

例えば

50cm > S > 20cm

ペットボトルは全てSサイズ
(500ml: 21cm, 1.5~2L: 31cm)

100cm > M > 50cm

サンダル, スーパーの袋
ボンデン, サッカーボール,
一升瓶, 一斗缶

200cm > L > 100cm

ごみ袋,
カラーコーン
(70cm)

LL > 200cm

ドラム缶(90cm)

種類の記入例

漂流物の例	種類	記号
	漁網	FGN
漁具	ボンデン 浮子	FGF
	その他 漁具	FGO
人工物	発泡スチロール	EPS
	レジ袋	PBA
	ペットボトル	PBO
	食品包装材(トレー, 弁当空, お菓子類袋など)	FP
	その他プラスチック製品	PC
	ガラス製品	G
	金属製品	M
	木材	W
	その他	UO
	天然物	流れ藻
流木		DW
その他		NO
その他不明	その他不明	UK

実例



Detected floating marine object 発見された漂流物の例

Fishing gear



Expanded Polystyren



PET bottle



Artificial

Including
Metal products
Glass products,
Timber etc.

Plastic sheet



Petrochemical piece



Natural

Seaweed

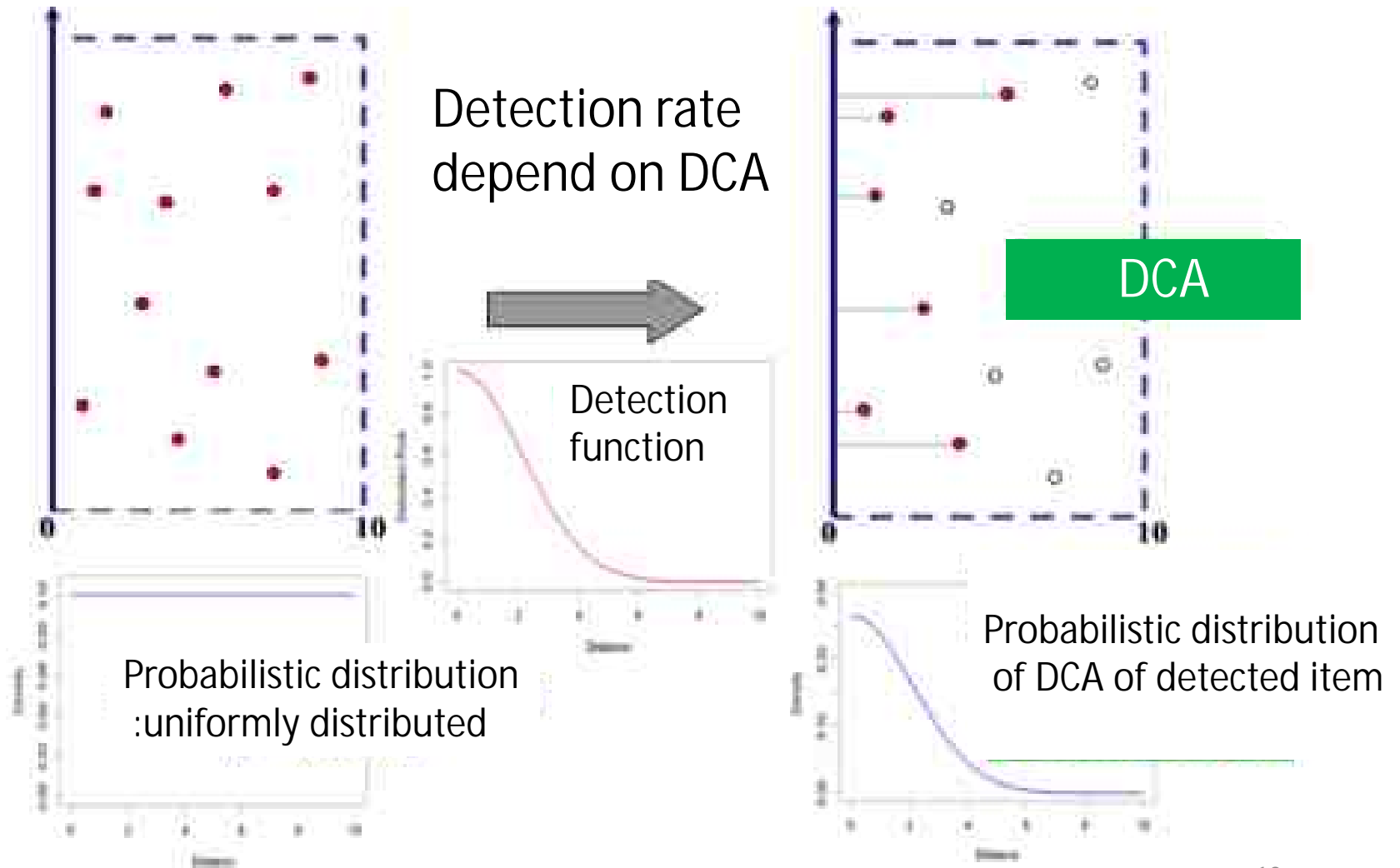


wood



Analysis method 解析方法

Relation between DCA and detection rate



Estimate Density 密度推定方法

1 . Estimate σ from DCA

2 . The ESHW (μ) is mathematically defined by detection function

3 . Circulate density (d) by

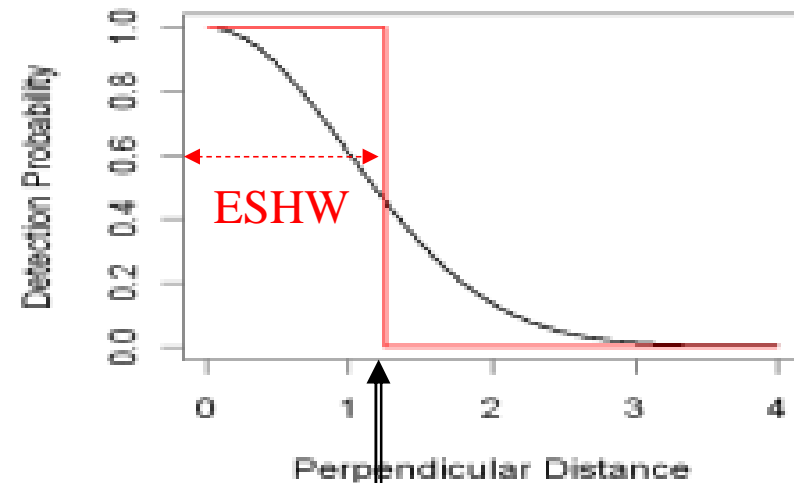
$$\hat{d} = \frac{n}{\hat{\mu} L}$$

L : observation distance

n : number of floating goods

Ex , Estimated with half normal

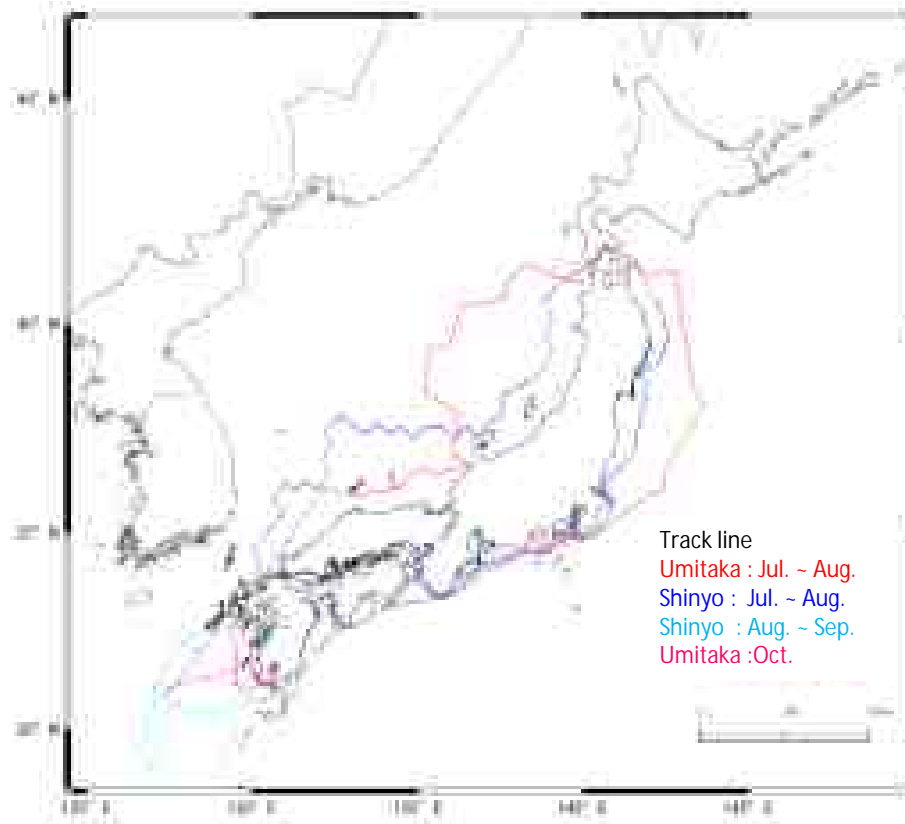
$$g(x) = \exp\left(-\frac{x^2}{2\sigma^2}\right)$$



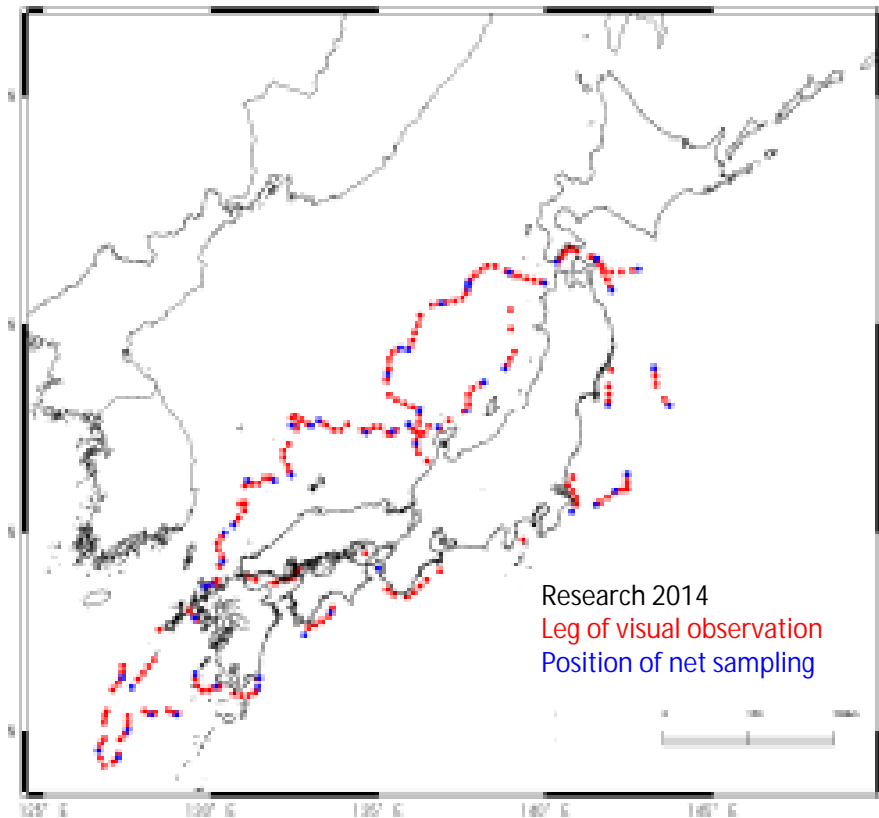
$$\mu \approx \sqrt{\frac{\pi}{2}} \sigma$$

effective search half-width (ESHW)

Research area 調査場所



Track line in 2014



Observation location in 2014

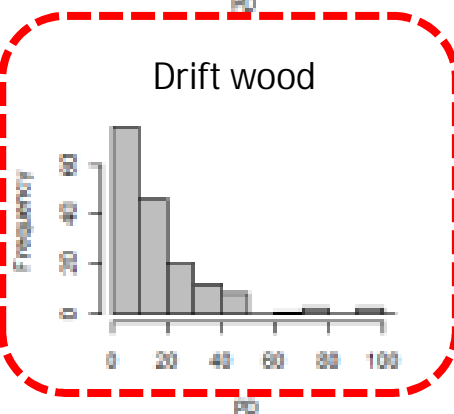
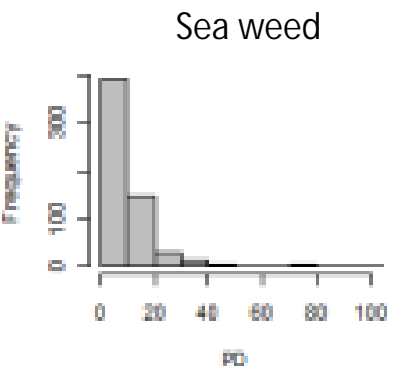
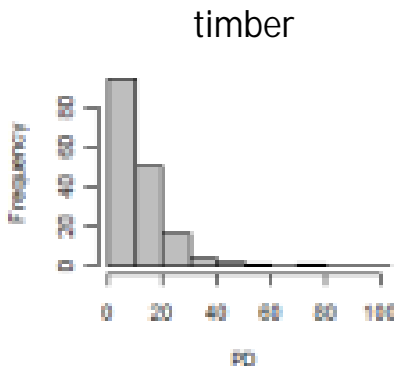
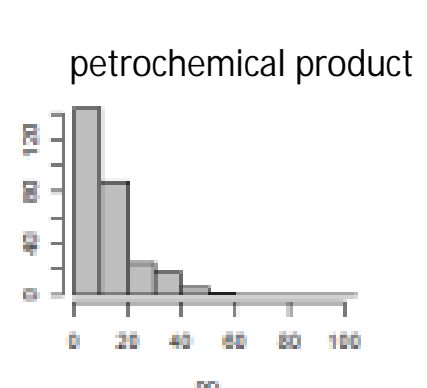
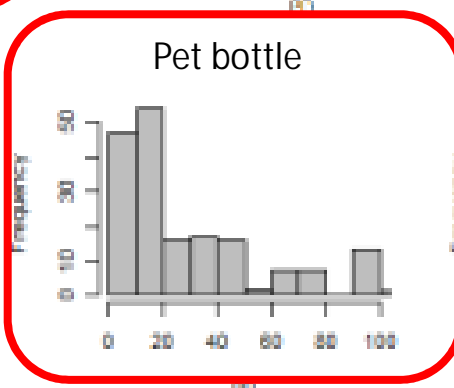
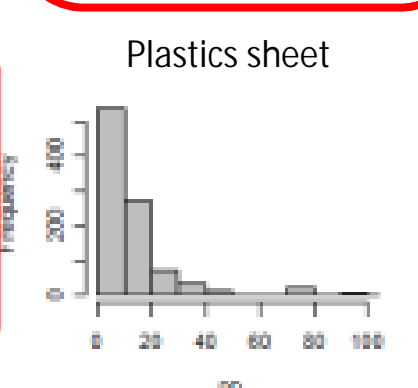
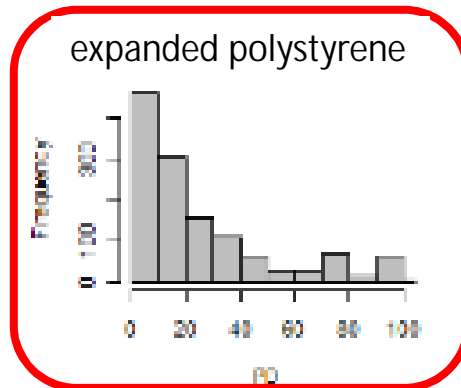
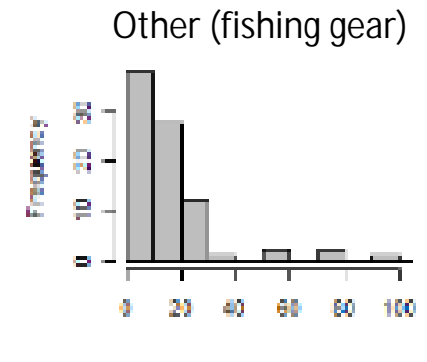
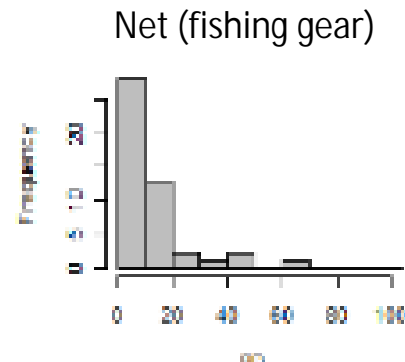
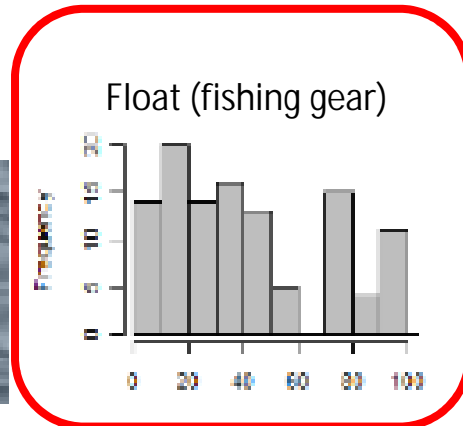
Umitaka maru	: 99	legs (1961.1km)
Shinyo maru	: 117	legs (2286.3km)
Total	: 216	legs (4247.5km)

Histogram of distance of closest approach of each item

種別の最接近距離のヒストグラム



Fishing float



Pet bottle

Detected items and each ESHW

種別の有効探索幅

Fishing gear

U:348m , S:247m

Expanded Polystyren

U : 150.3m , S : 93.8m

PET bottle

U : 67.7m , S : 52.0m

Artificial

Including
Metal products
Glass products ,
Timber etc.

Plastic sheet

U : 47.3m , S : 37.6m

Petrochemical piece

U : 22.1m , S : 24m

Under water

Natural

Seaweed

U : 33.5m , S : 17.9m

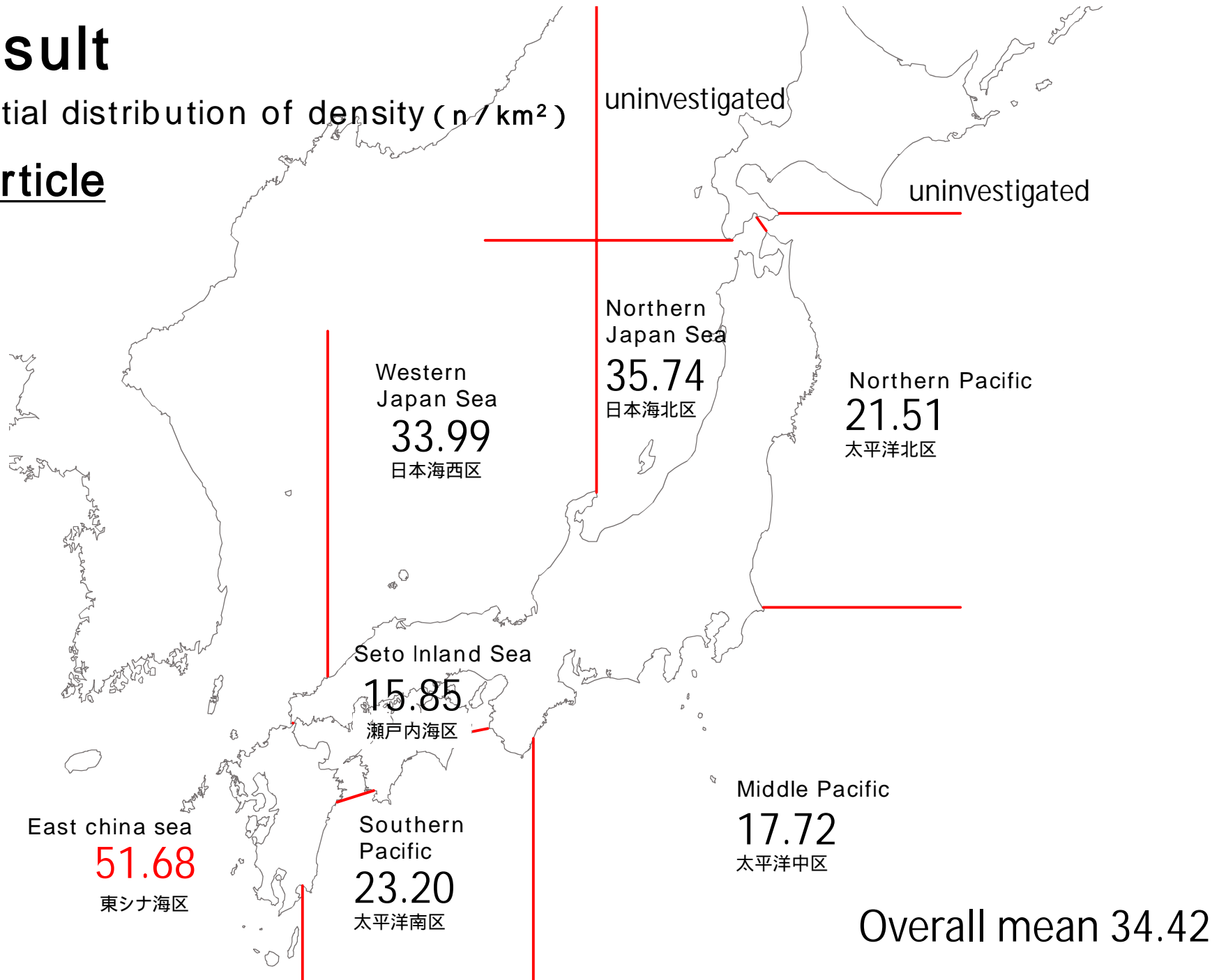
wood

U : 33.5m , S : 17.9m

Result

Spatial distribution of density (n / km^2)

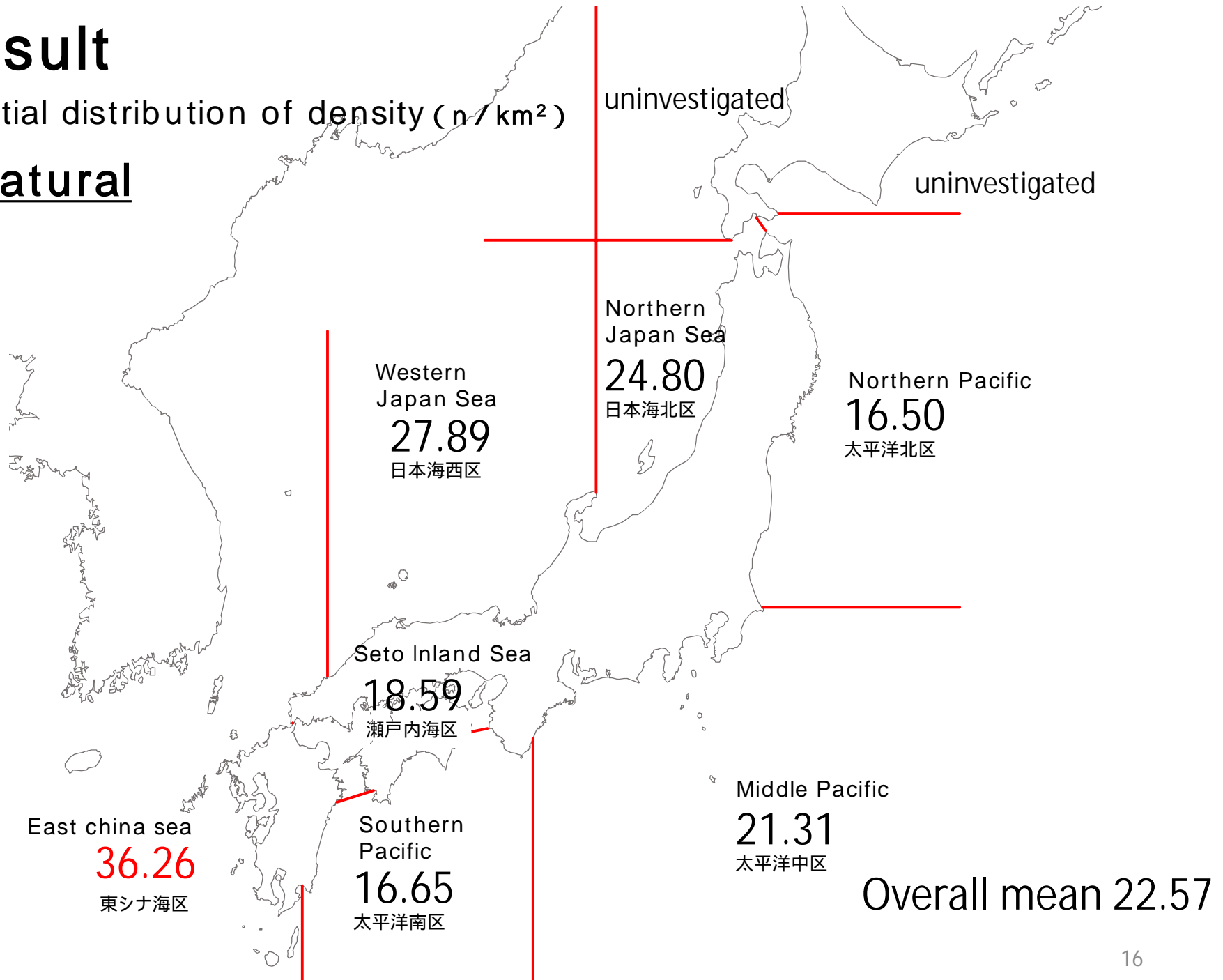
Article



Result

Spatial distribution of density (n / km^2)

Natural

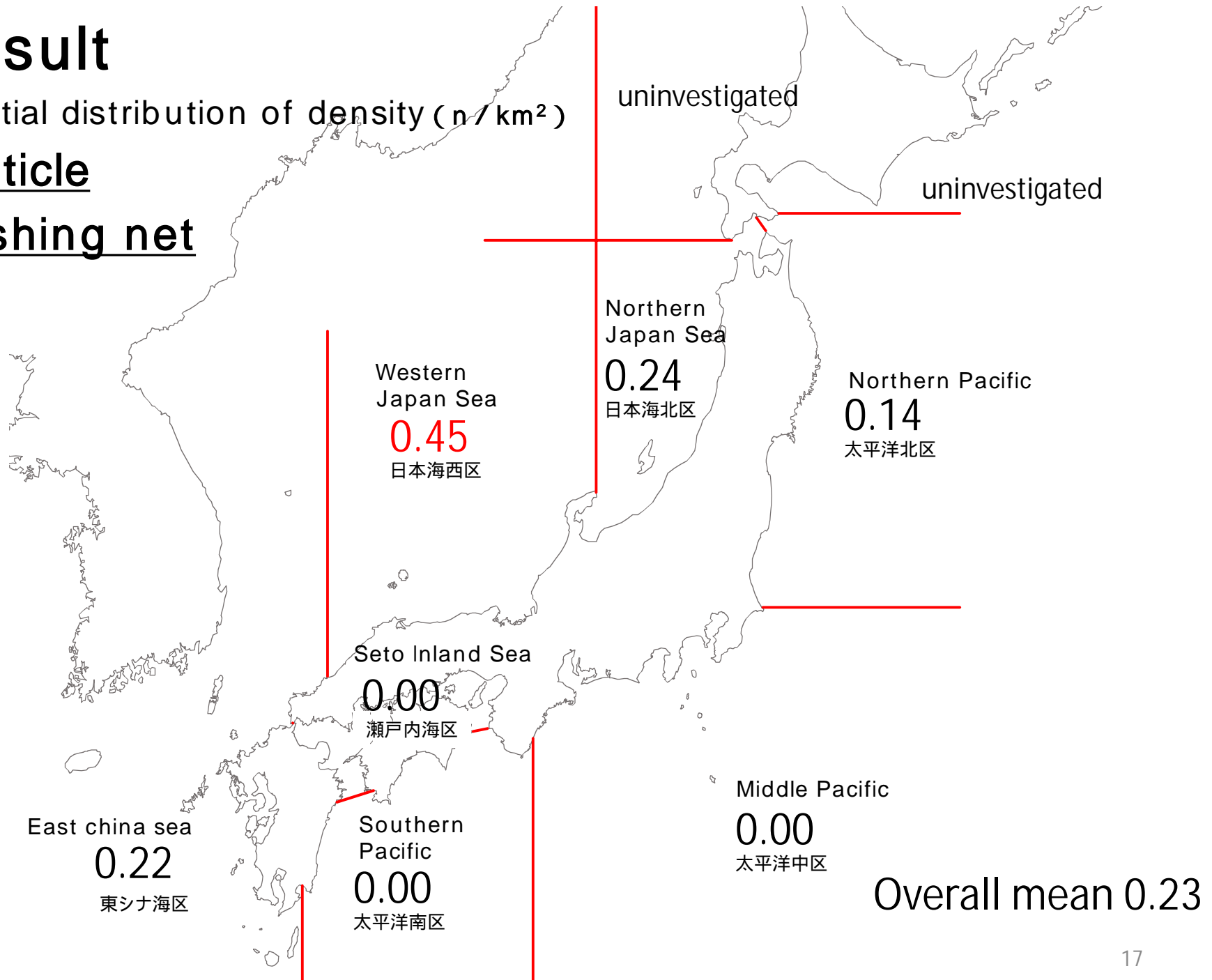


Result

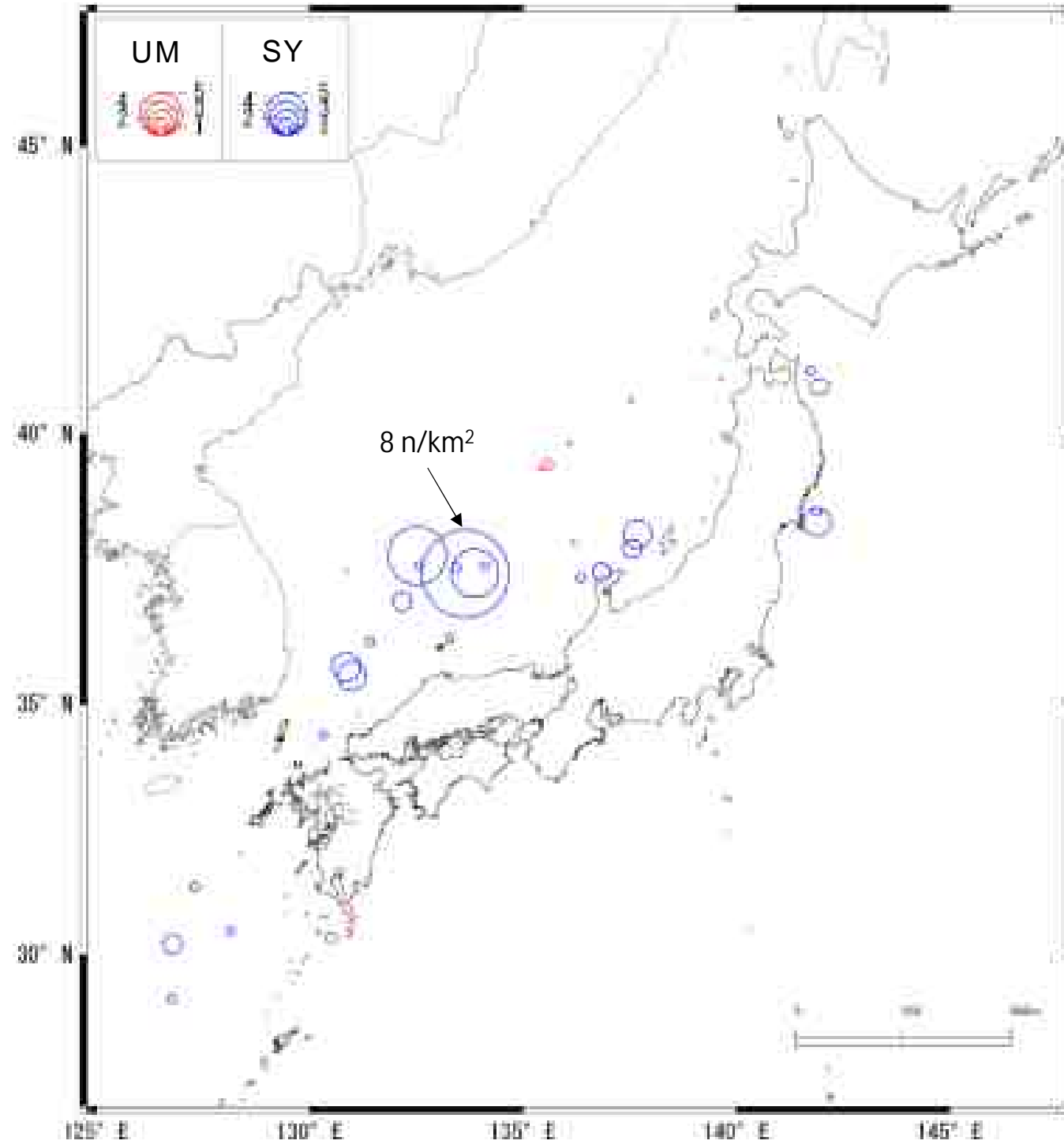
Spatial distribution of density (n / km^2)

Article

Fishing net



Fishing net

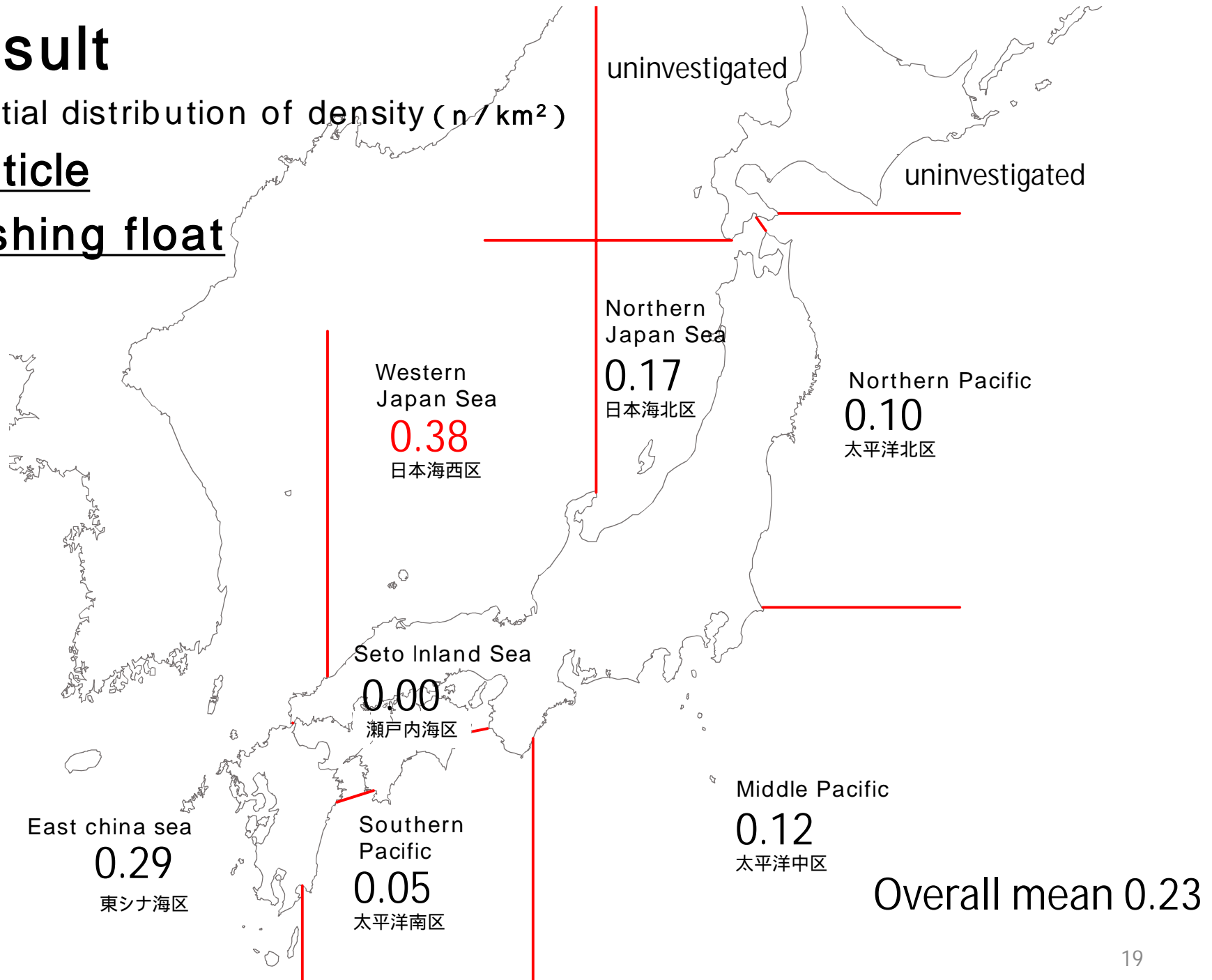


Result

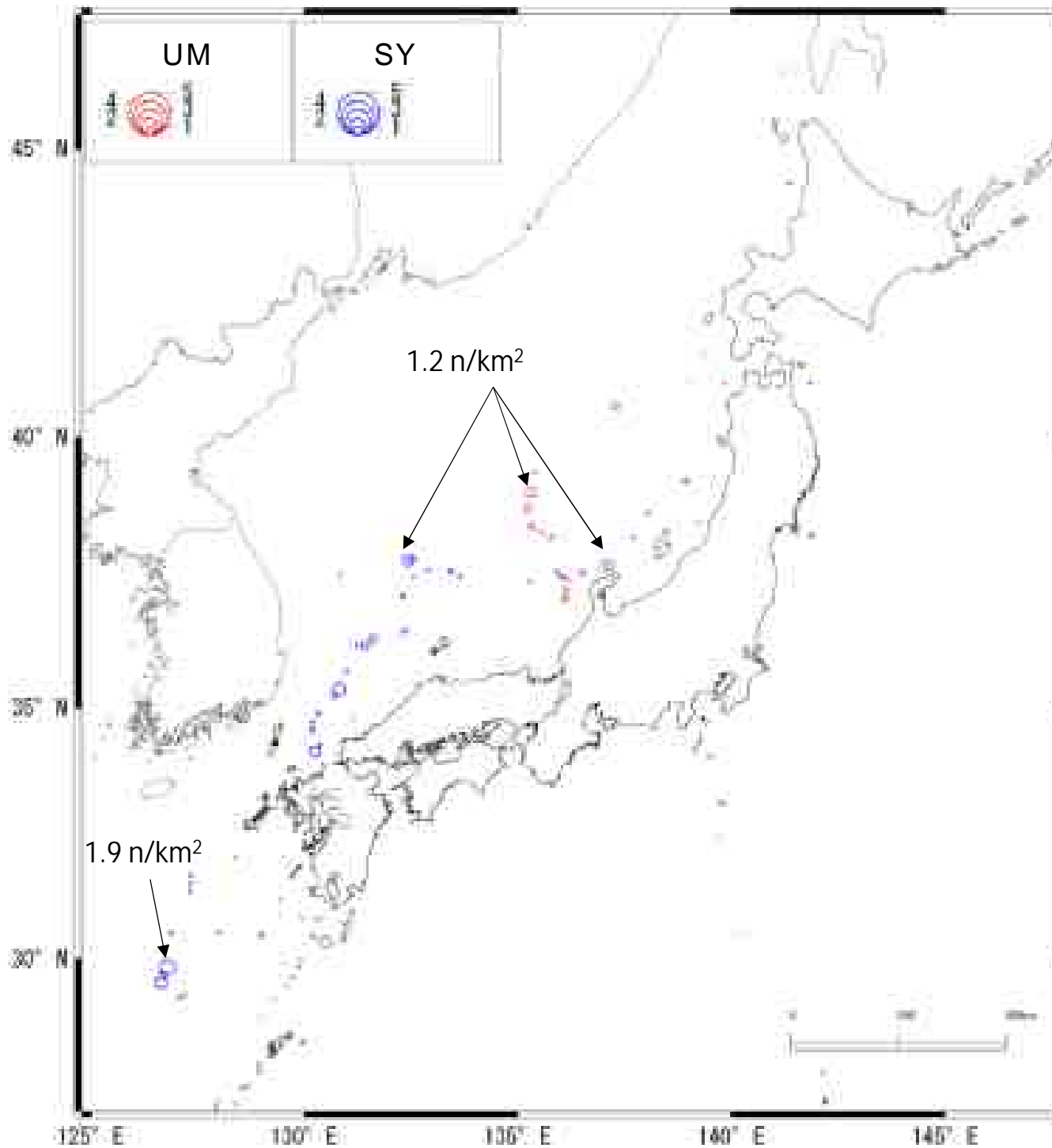
Spatial distribution of density (n / km^2)

Article

Fishing float



Fishing float

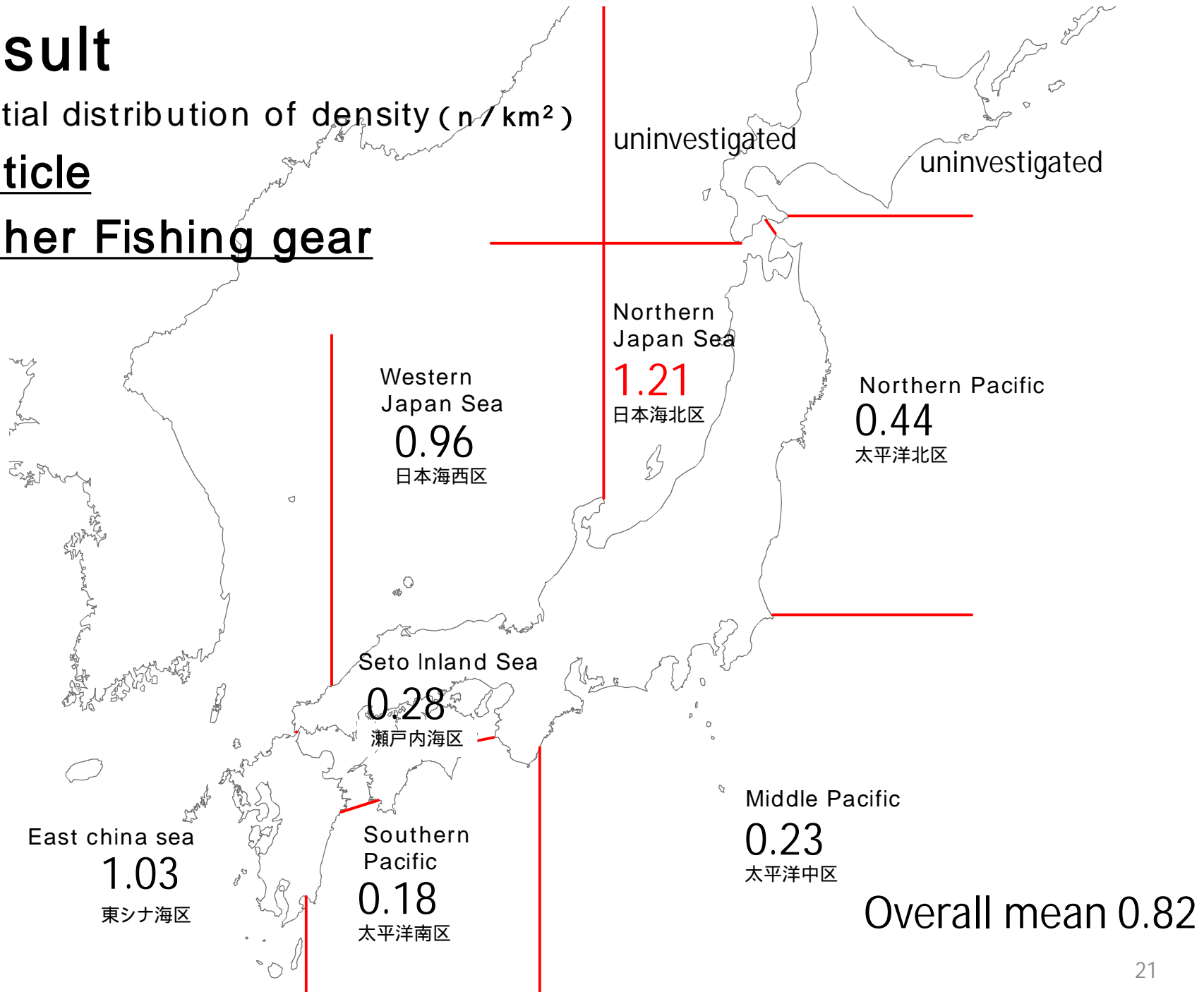


Result

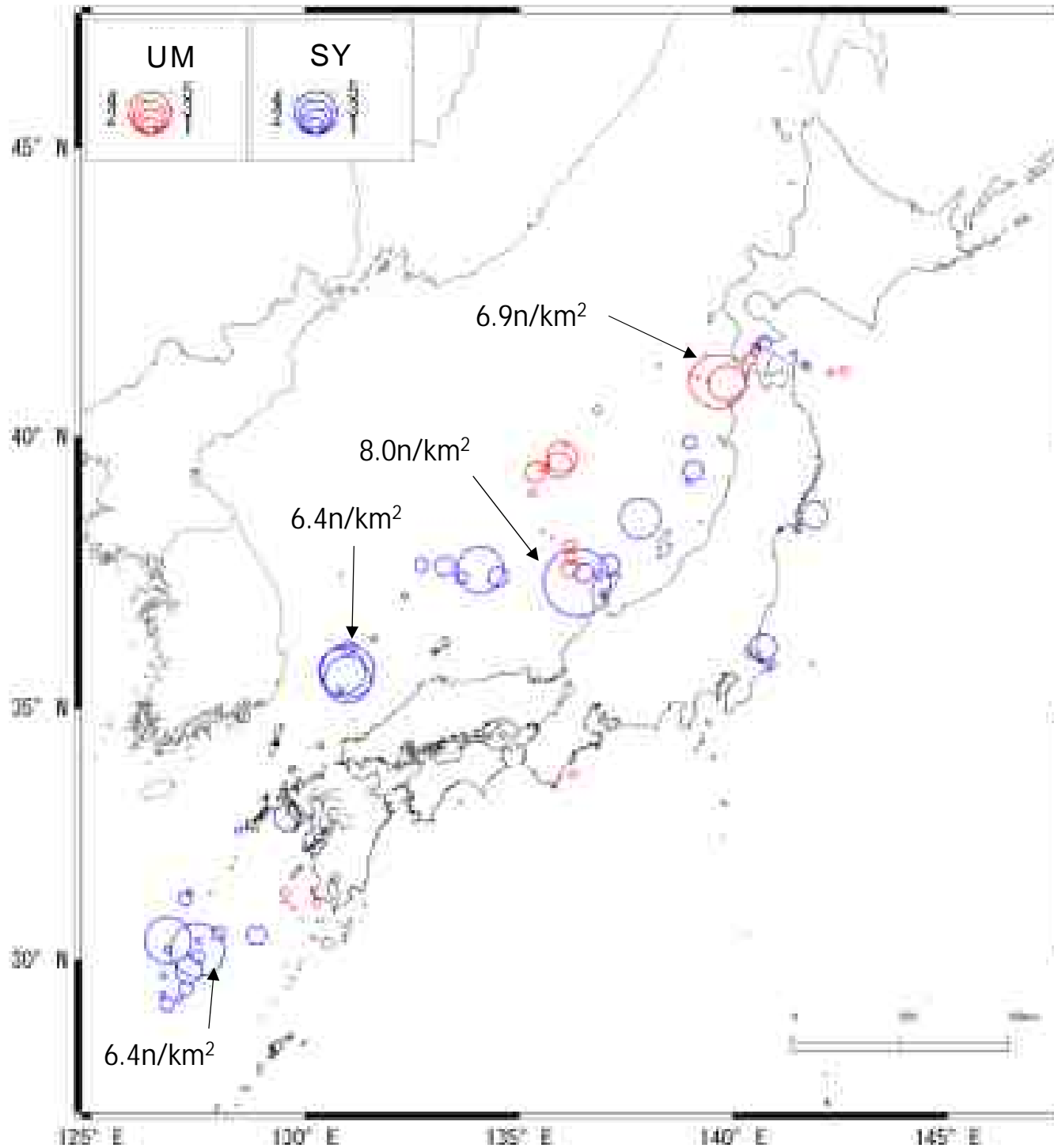
Spatial distribution of density (n / km^2)

Article

Other Fishing gear



Fishing float

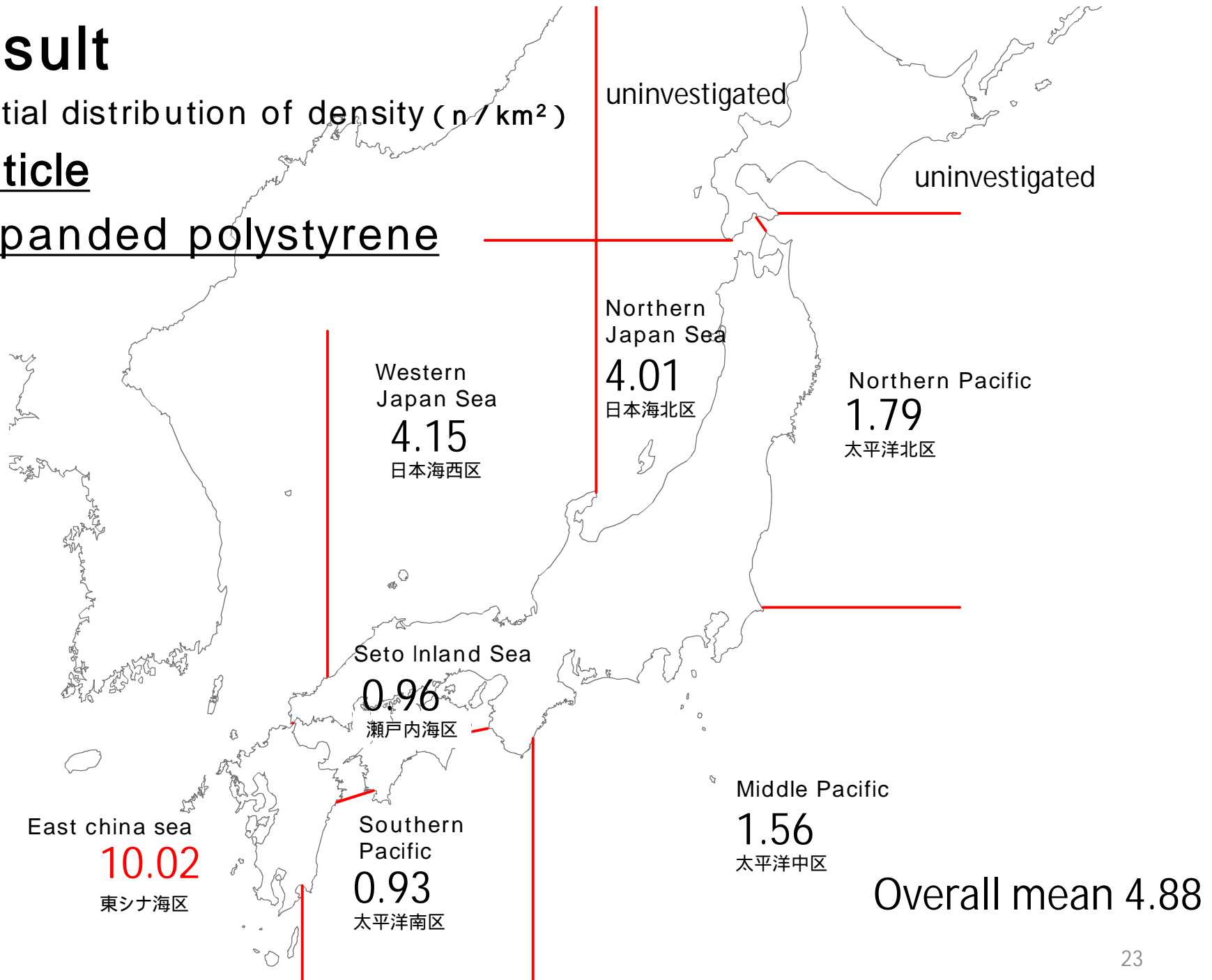


Result

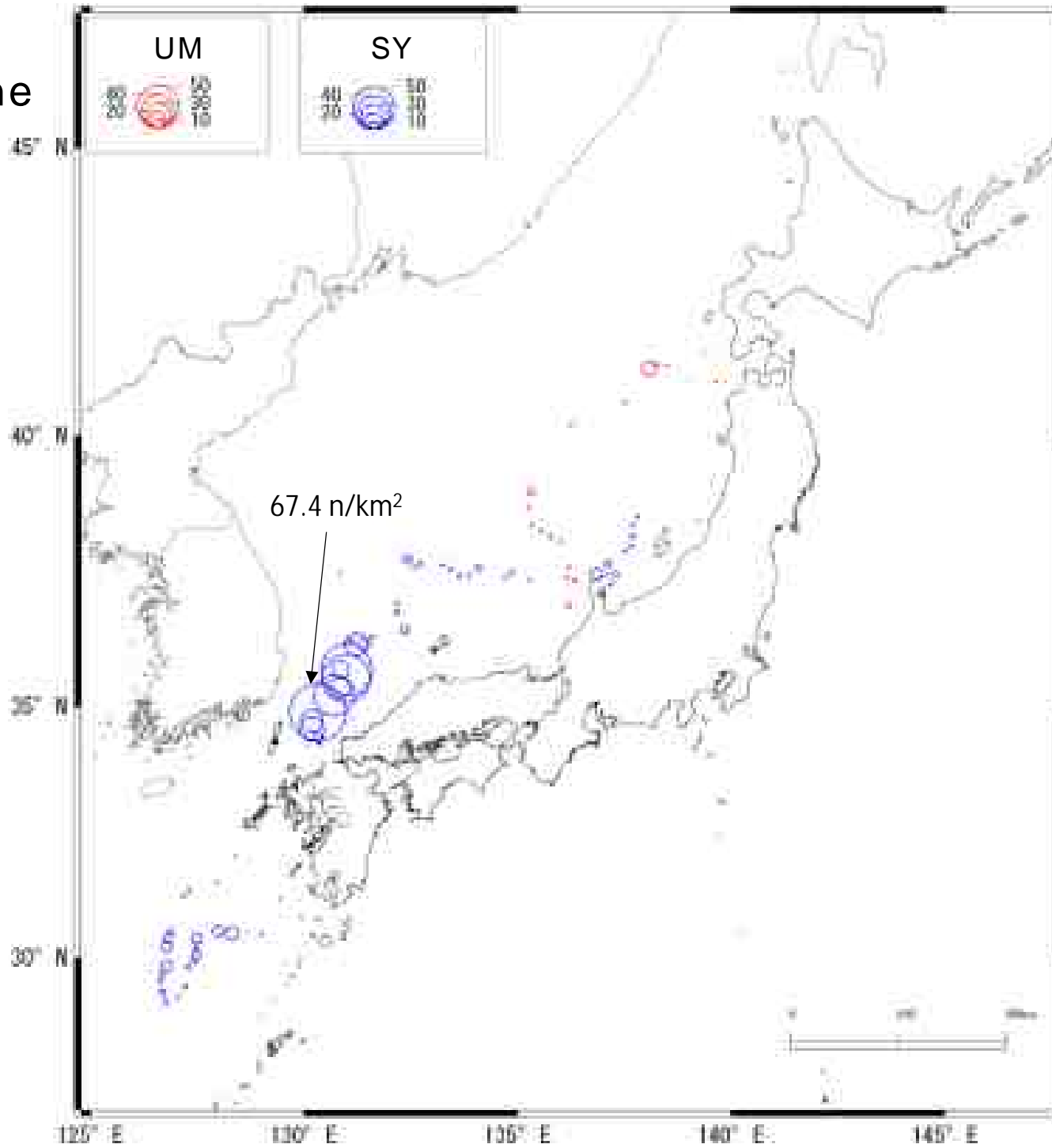
Spatial distribution of density (n / km^2)

Article

expanded polystyrene



expanded
polystyrene

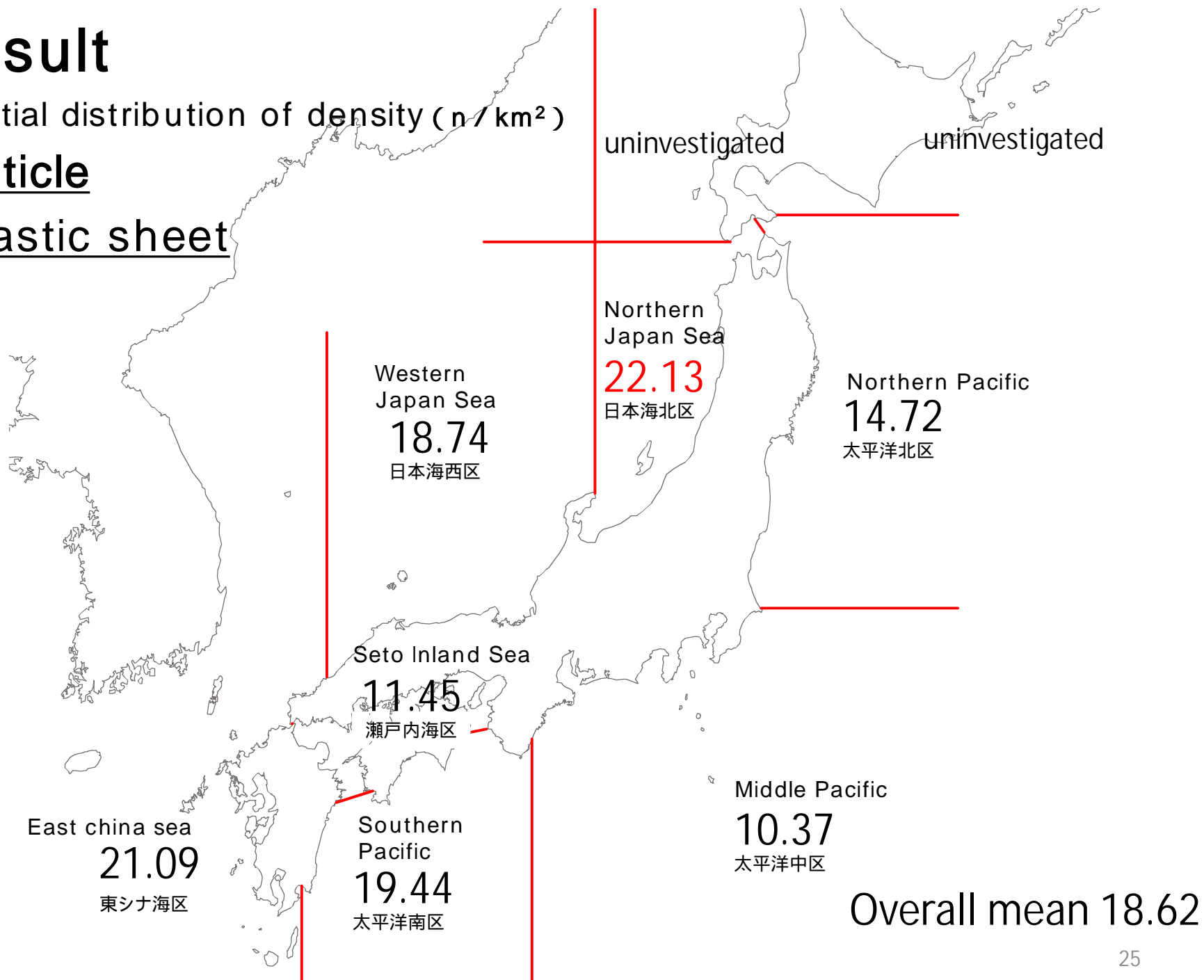


Result

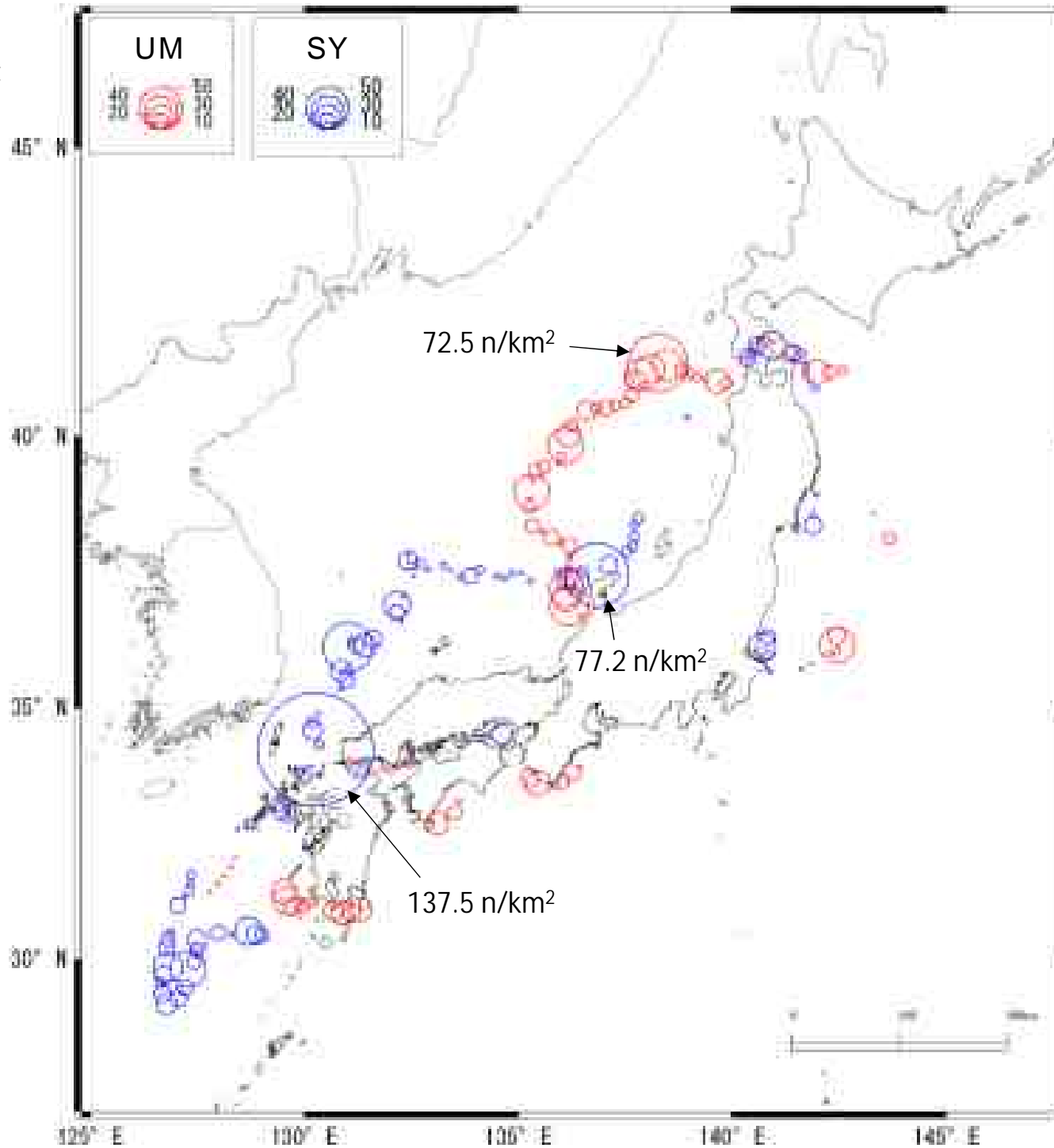
Spatial distribution of density (n / km^2)

Article

Plastic sheet



Plastic sheet

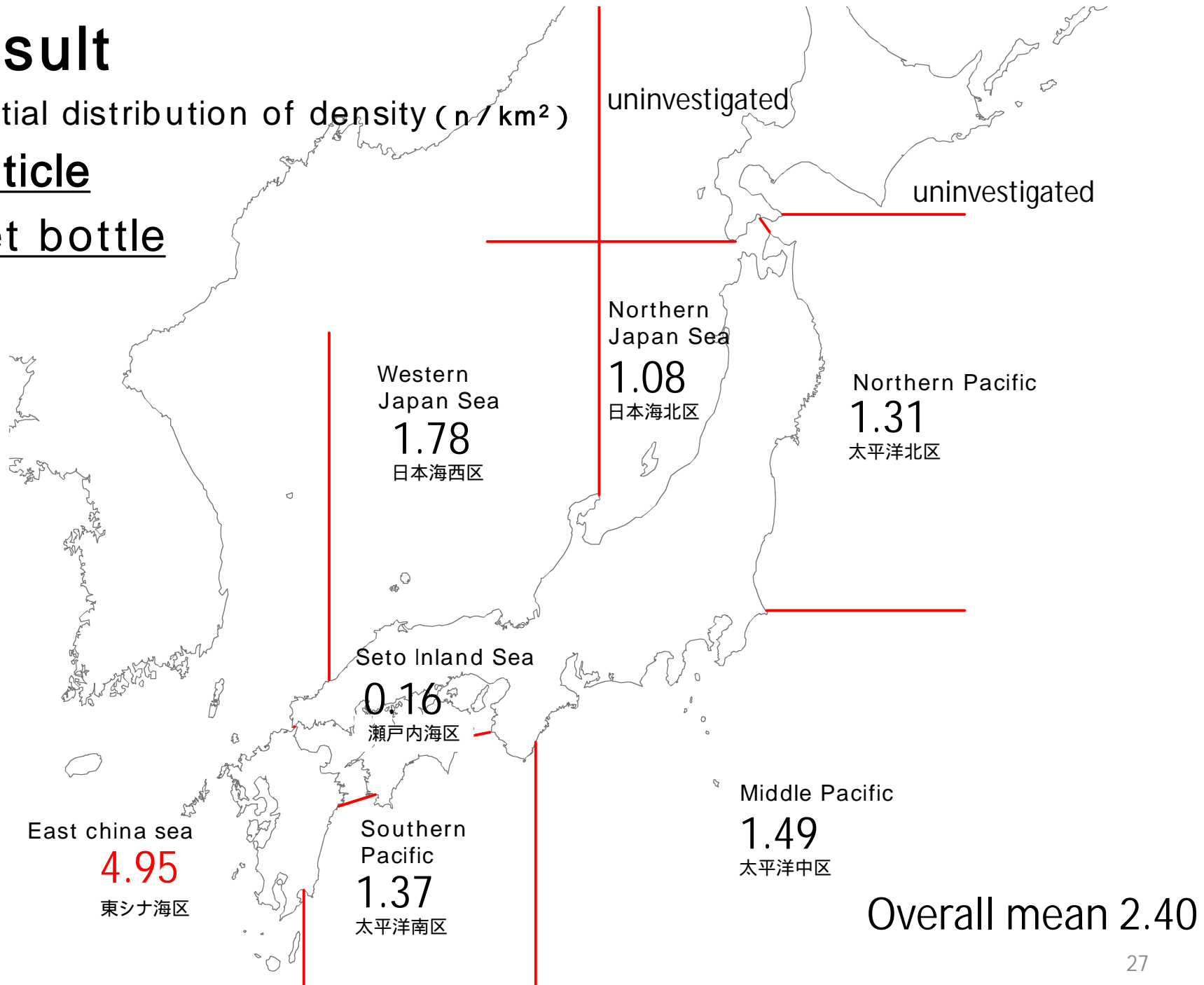


Result

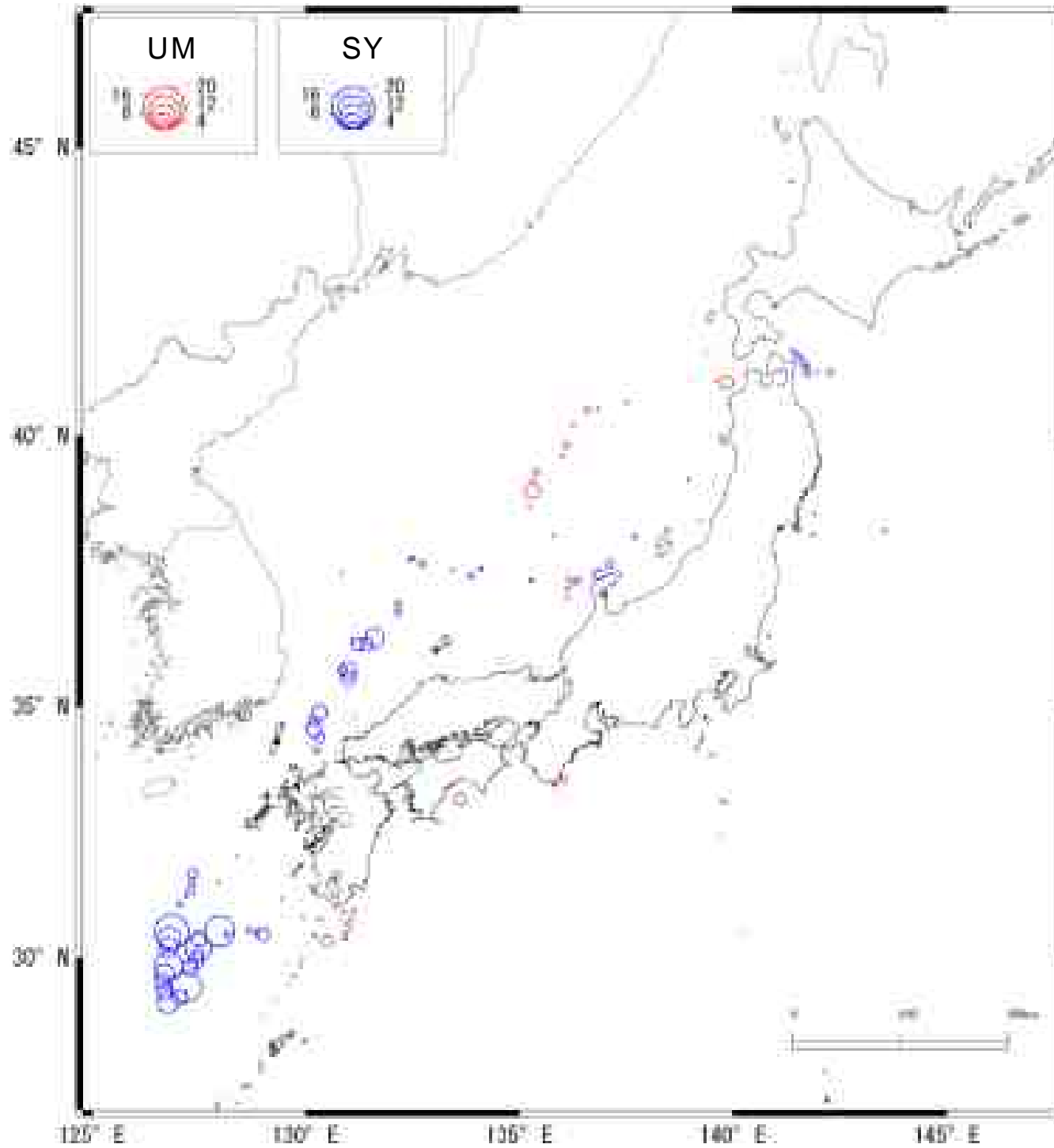
Spatial distribution of density (n / km^2)

Article

Pet bottle



Pet bottle

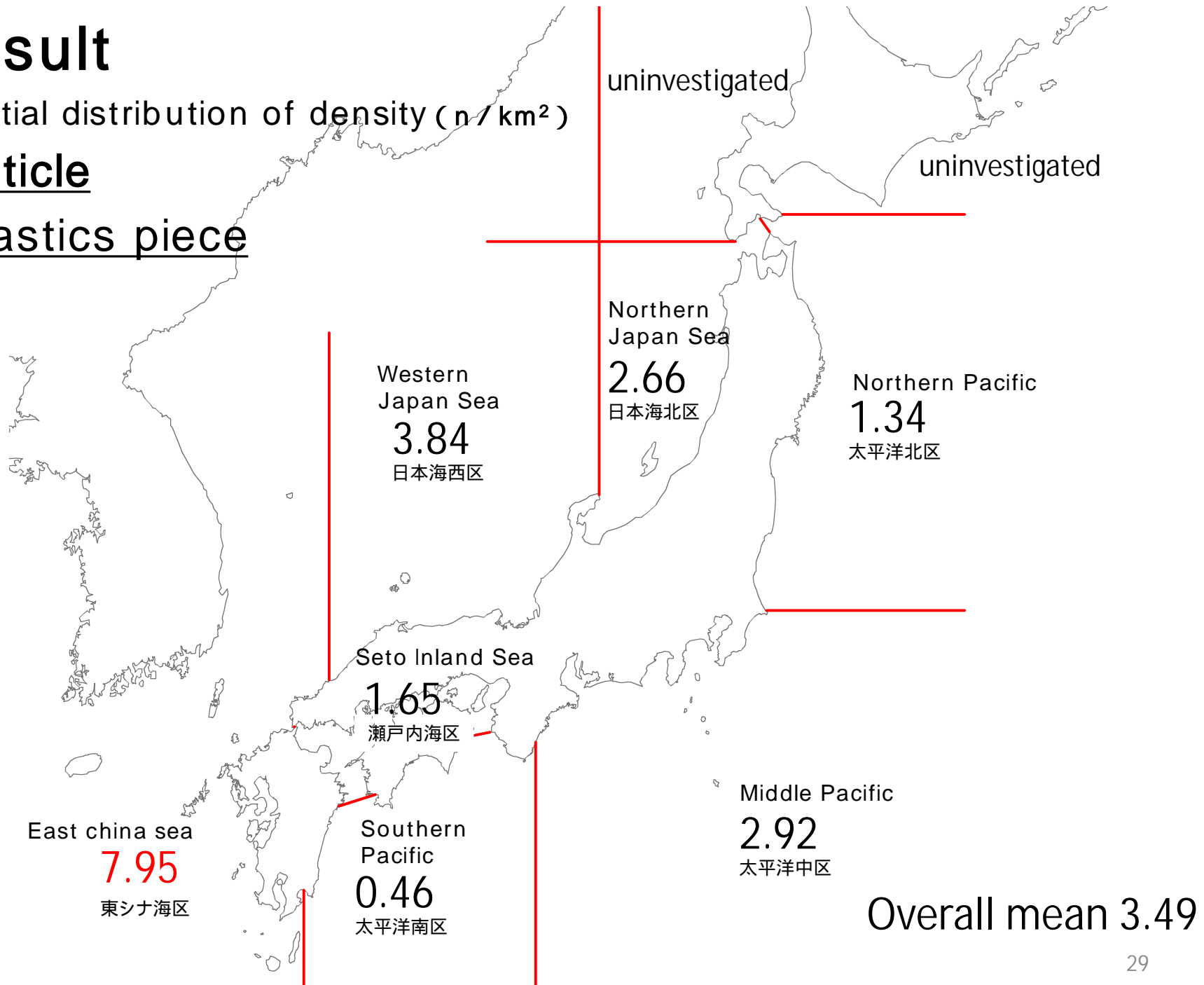


Result

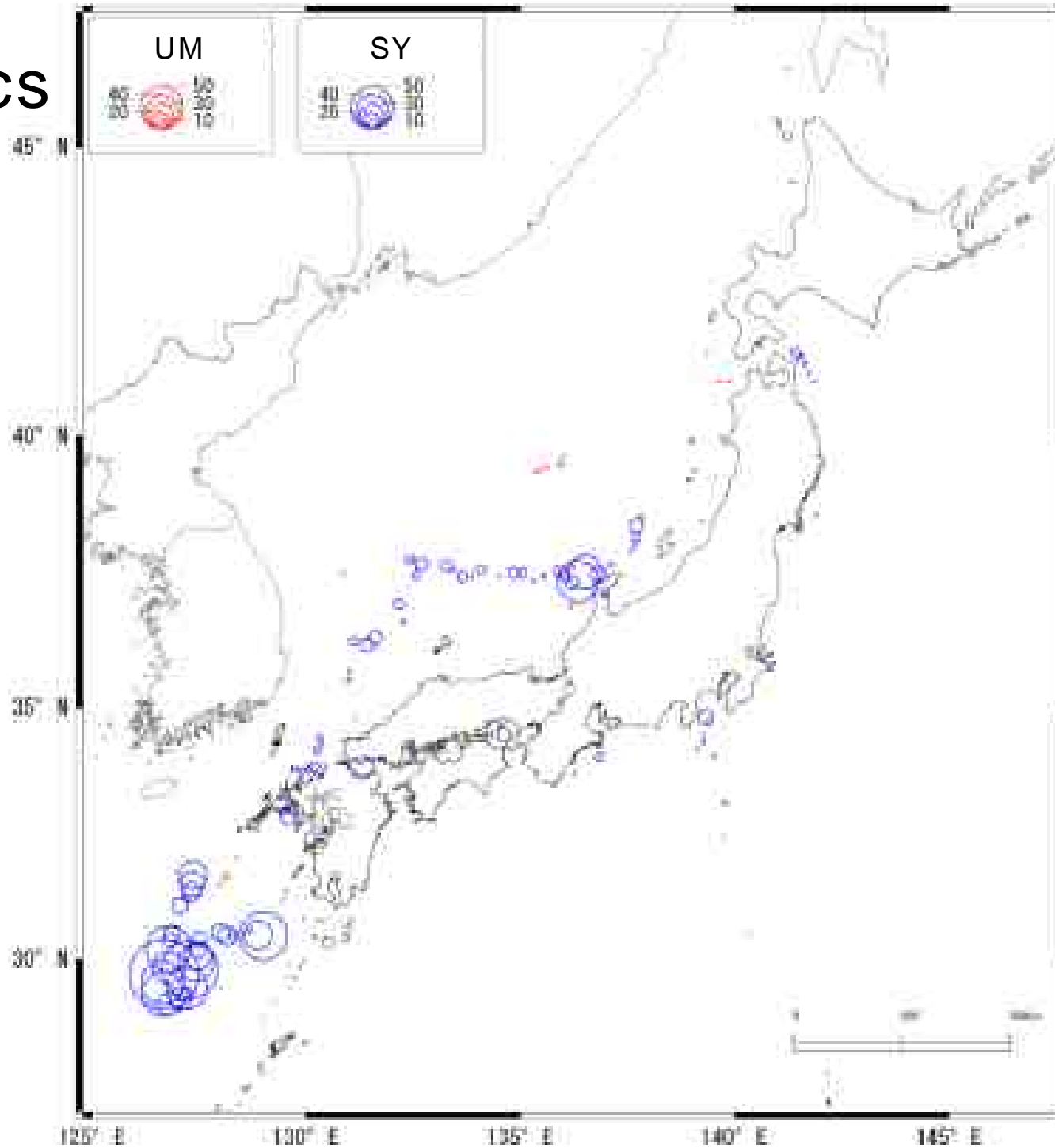
Spatial distribution of density (n / km^2)

Article

Plastics piece



Plastics piece

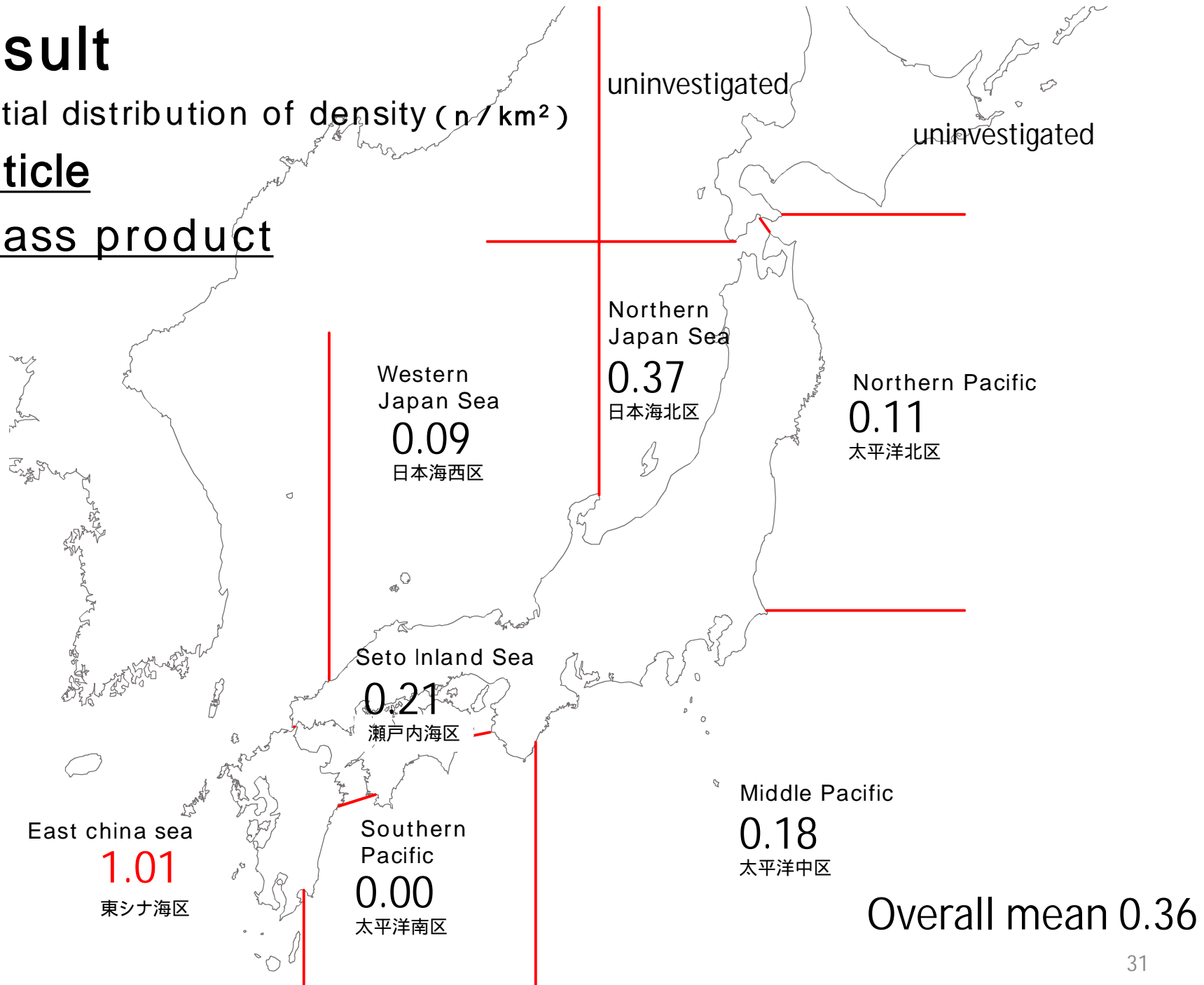


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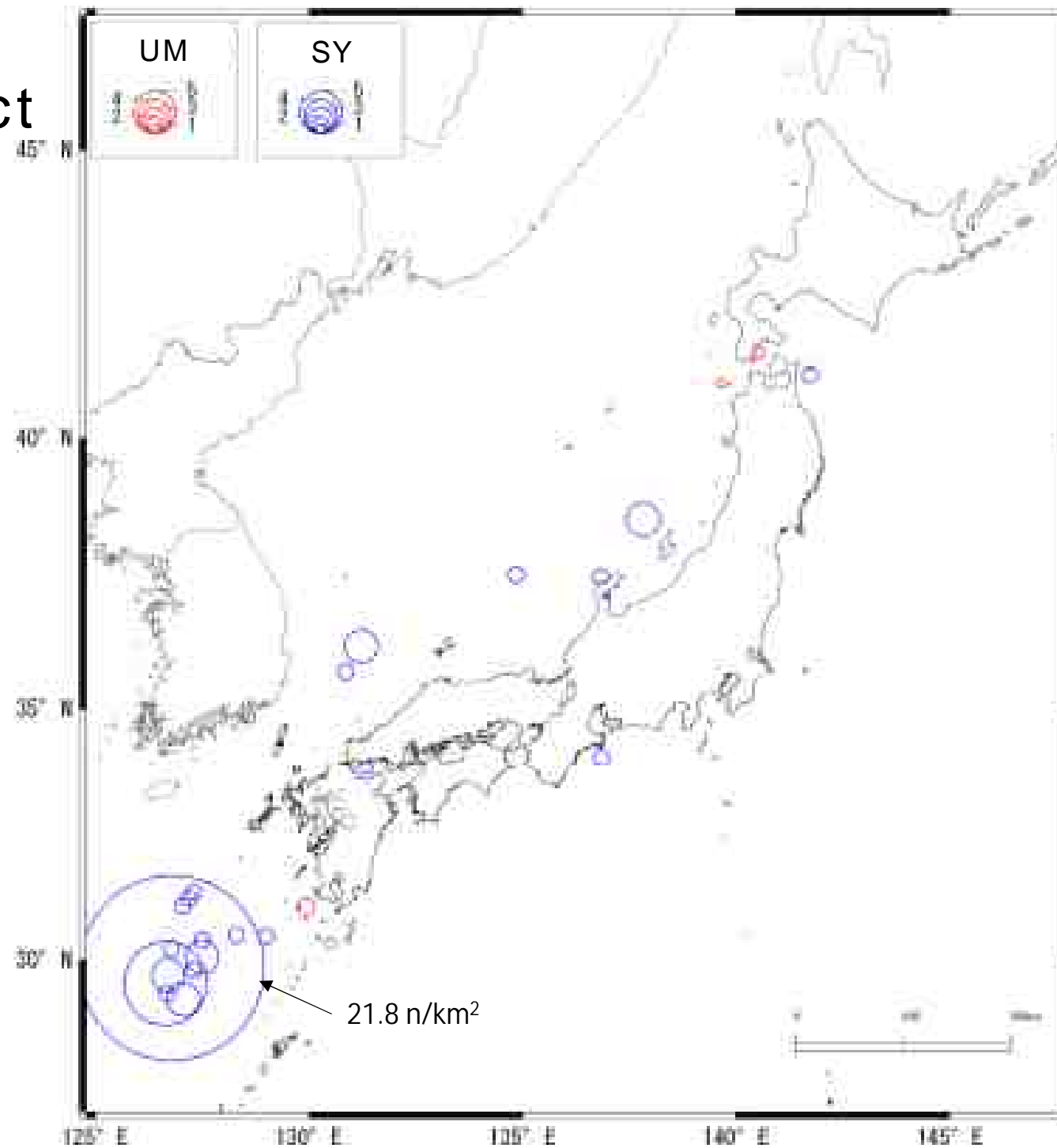
Spatial distribution of density (n / km^2)

Article

Grass product



Grass product

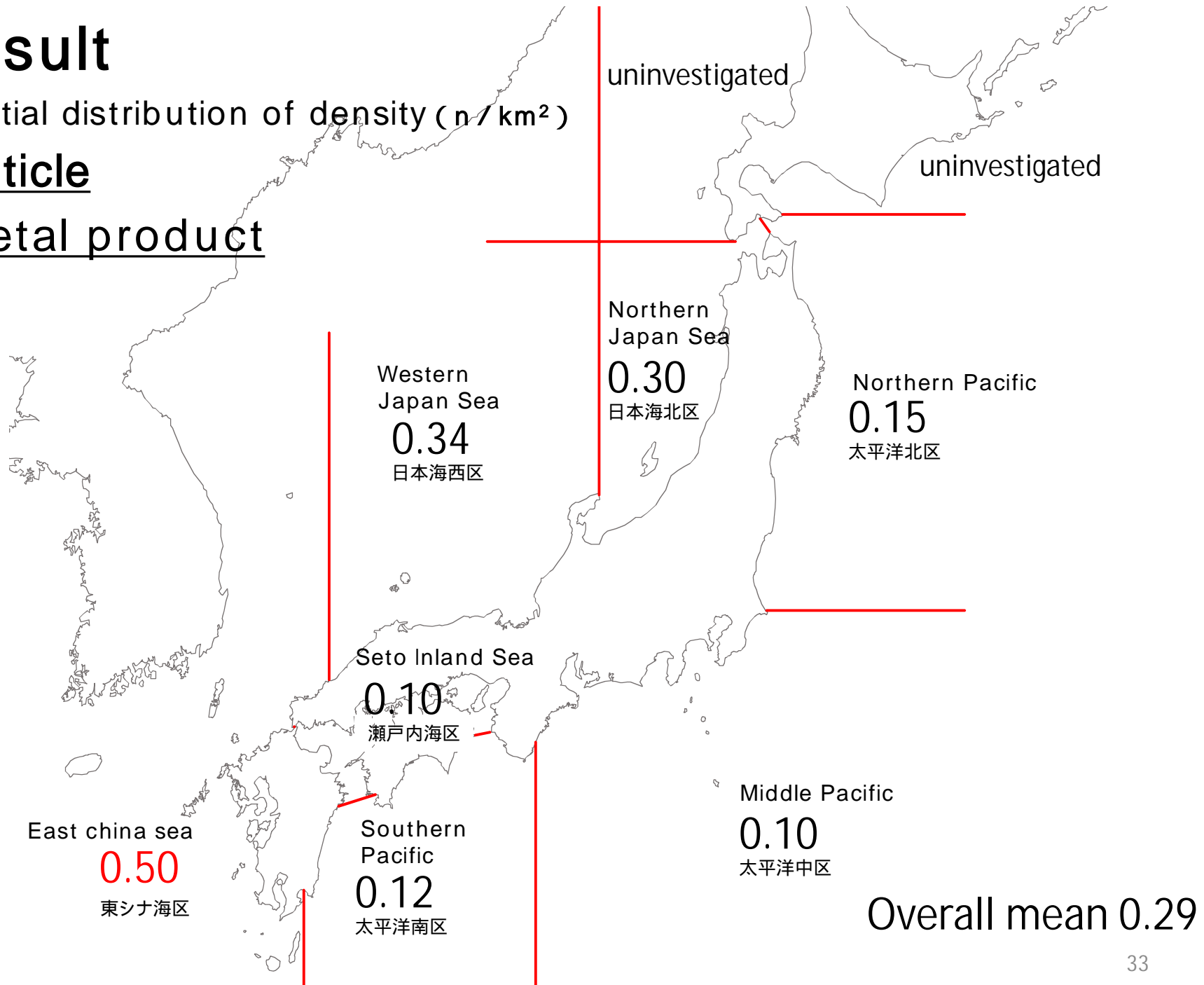


Result

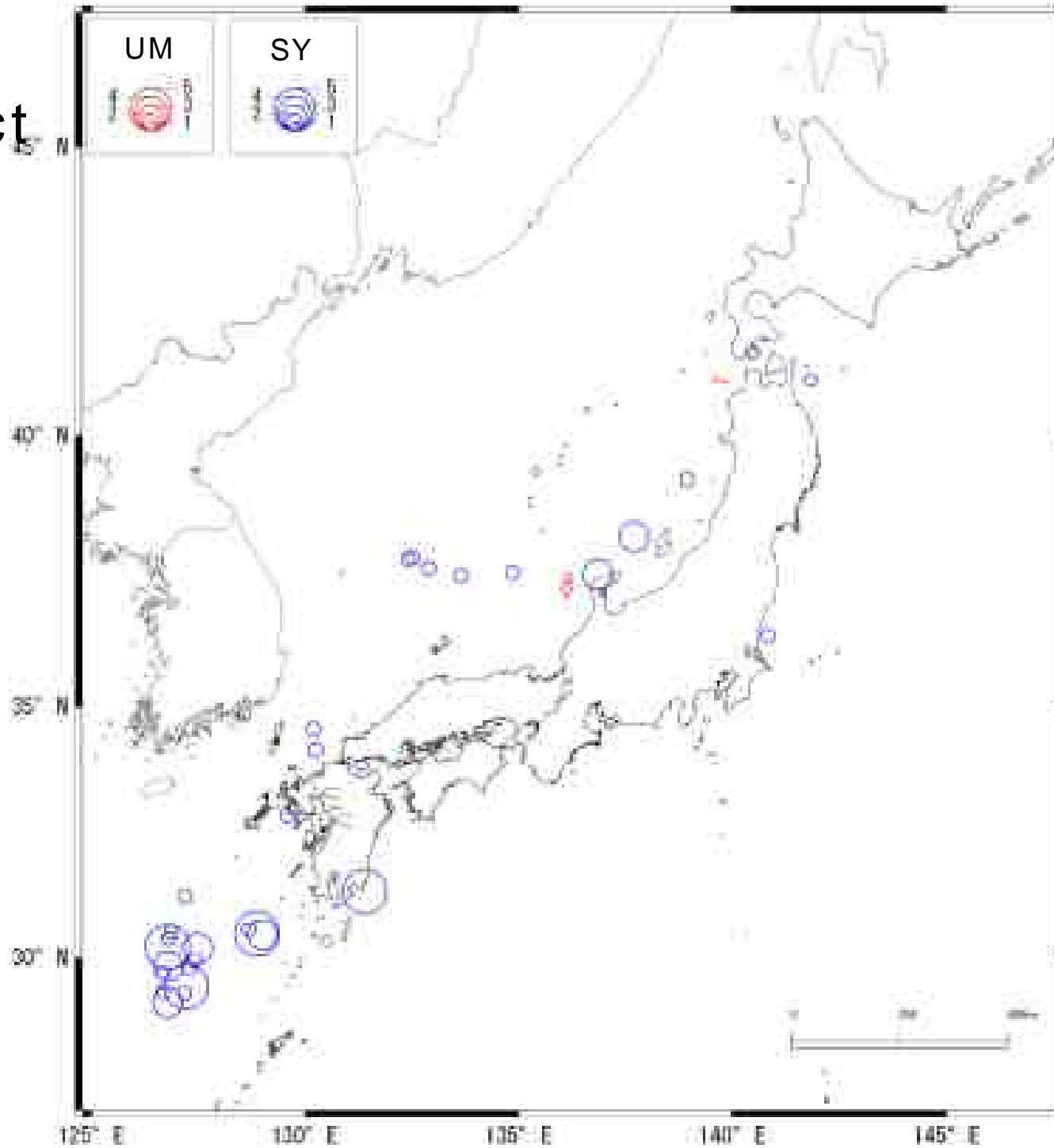
Spatial distribution of density (n / km^2)

Article

Metal product



Metal product

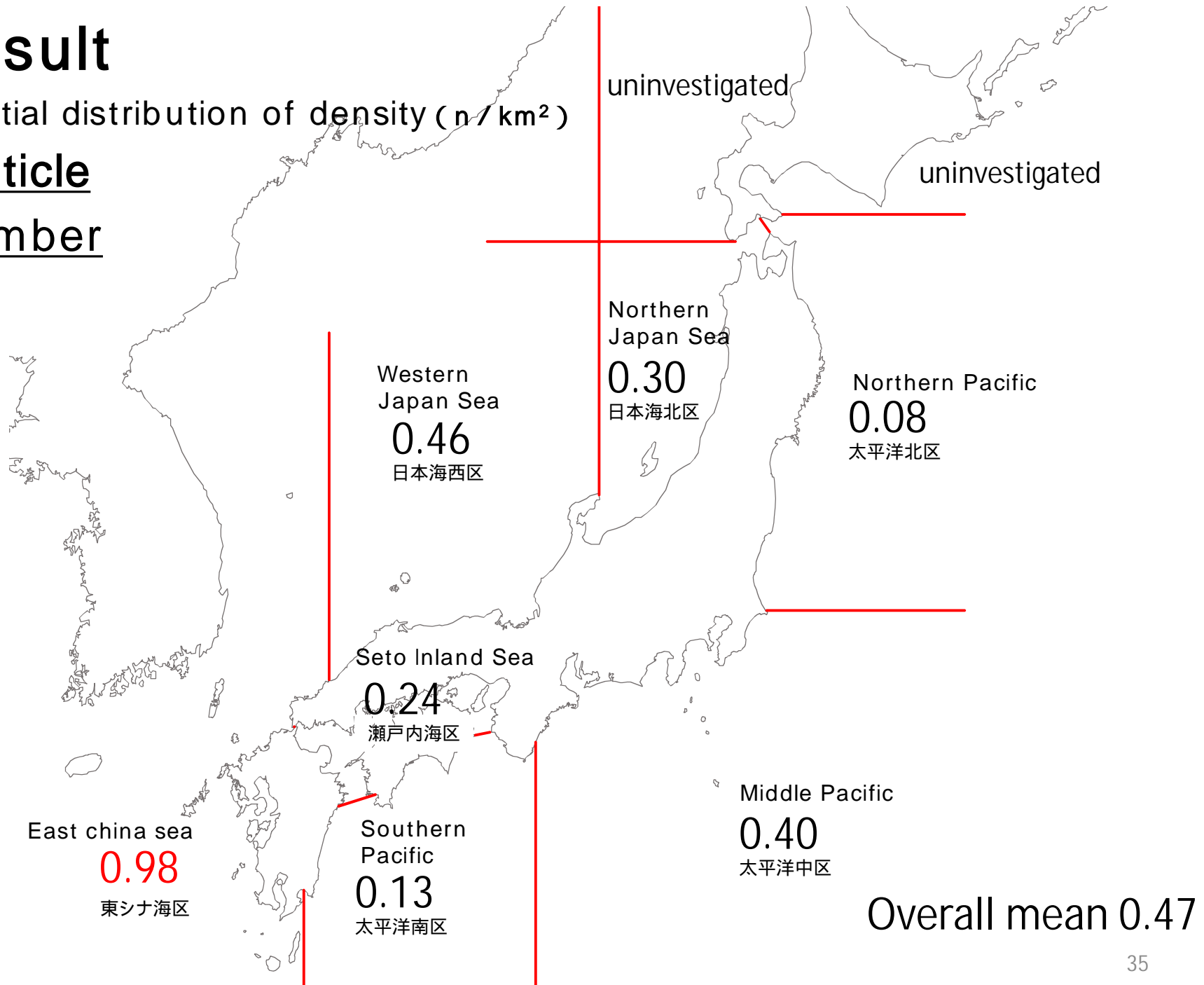


Result

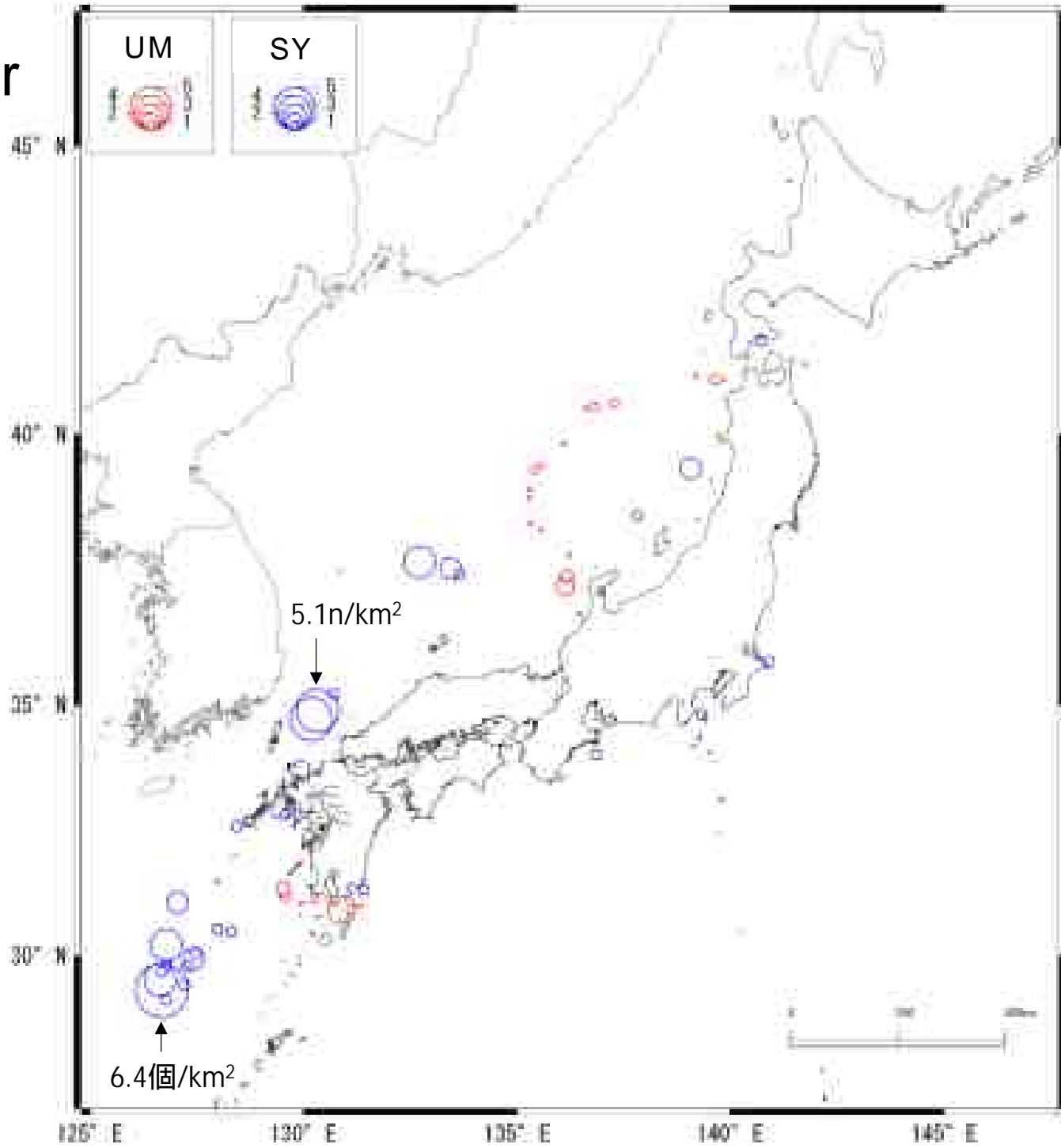
Spatial distribution of density (n / km^2)

Article

Timber



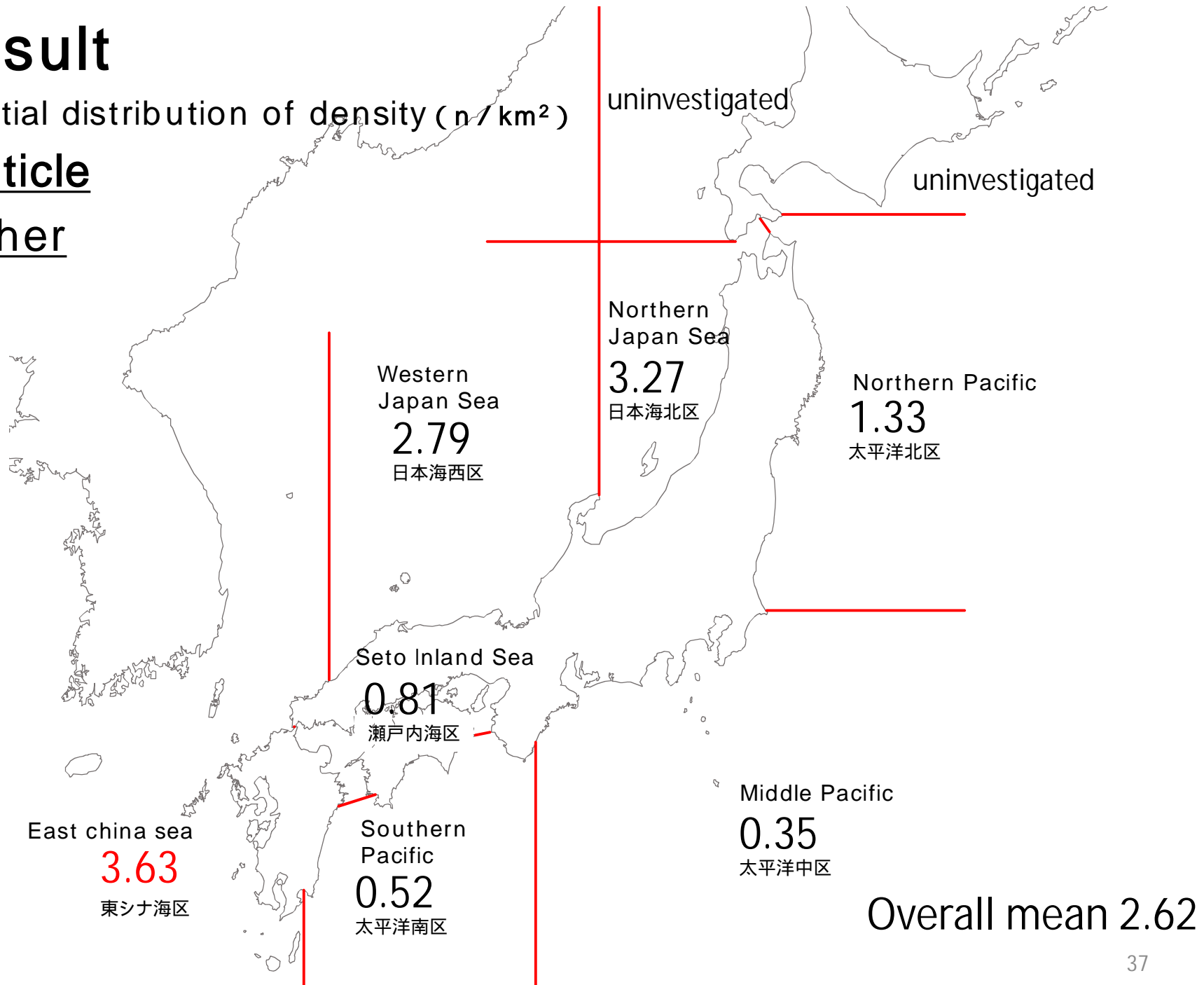
Timber



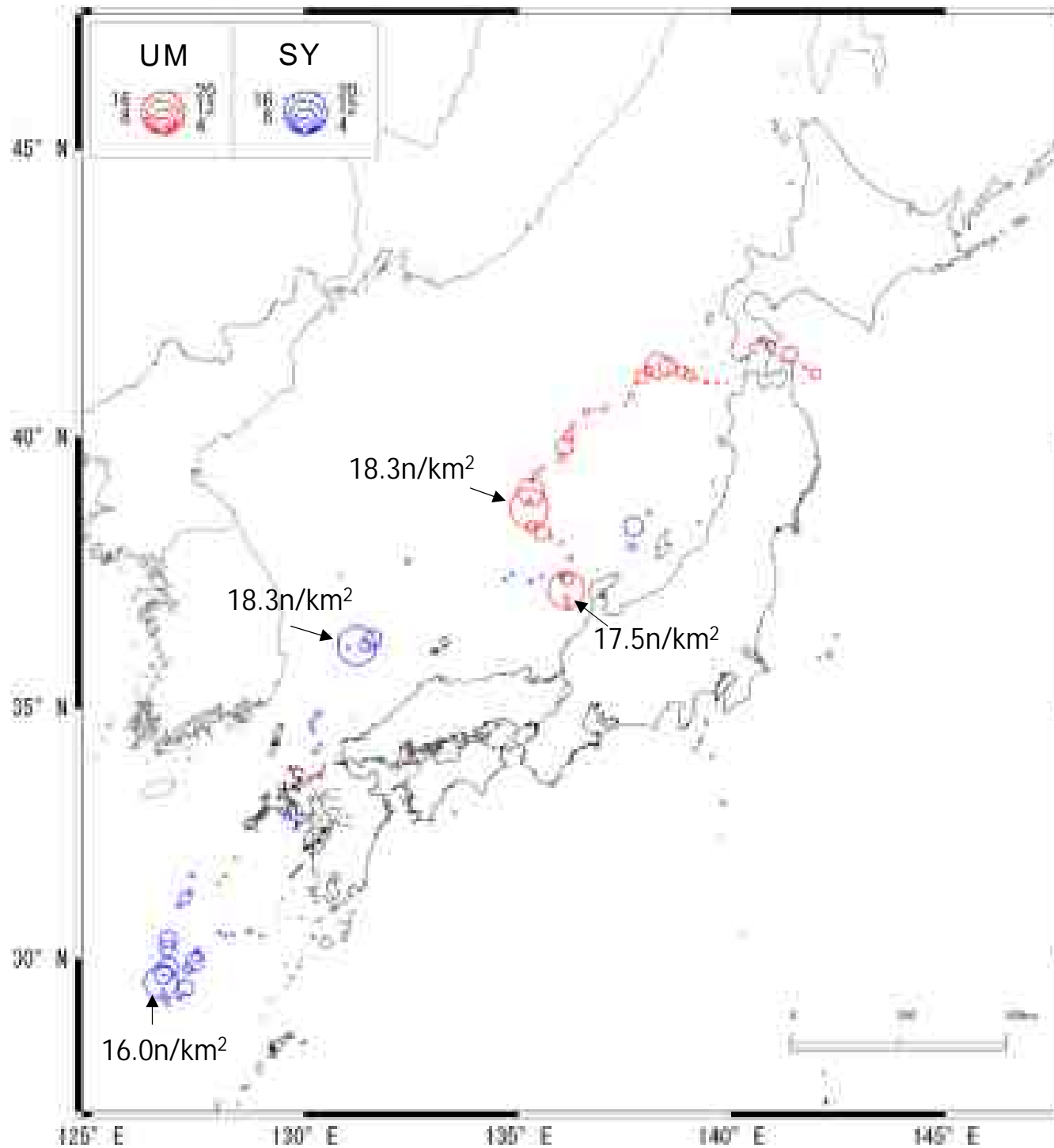
Result

Spatial distribution of density (n / km^2)

Article
other



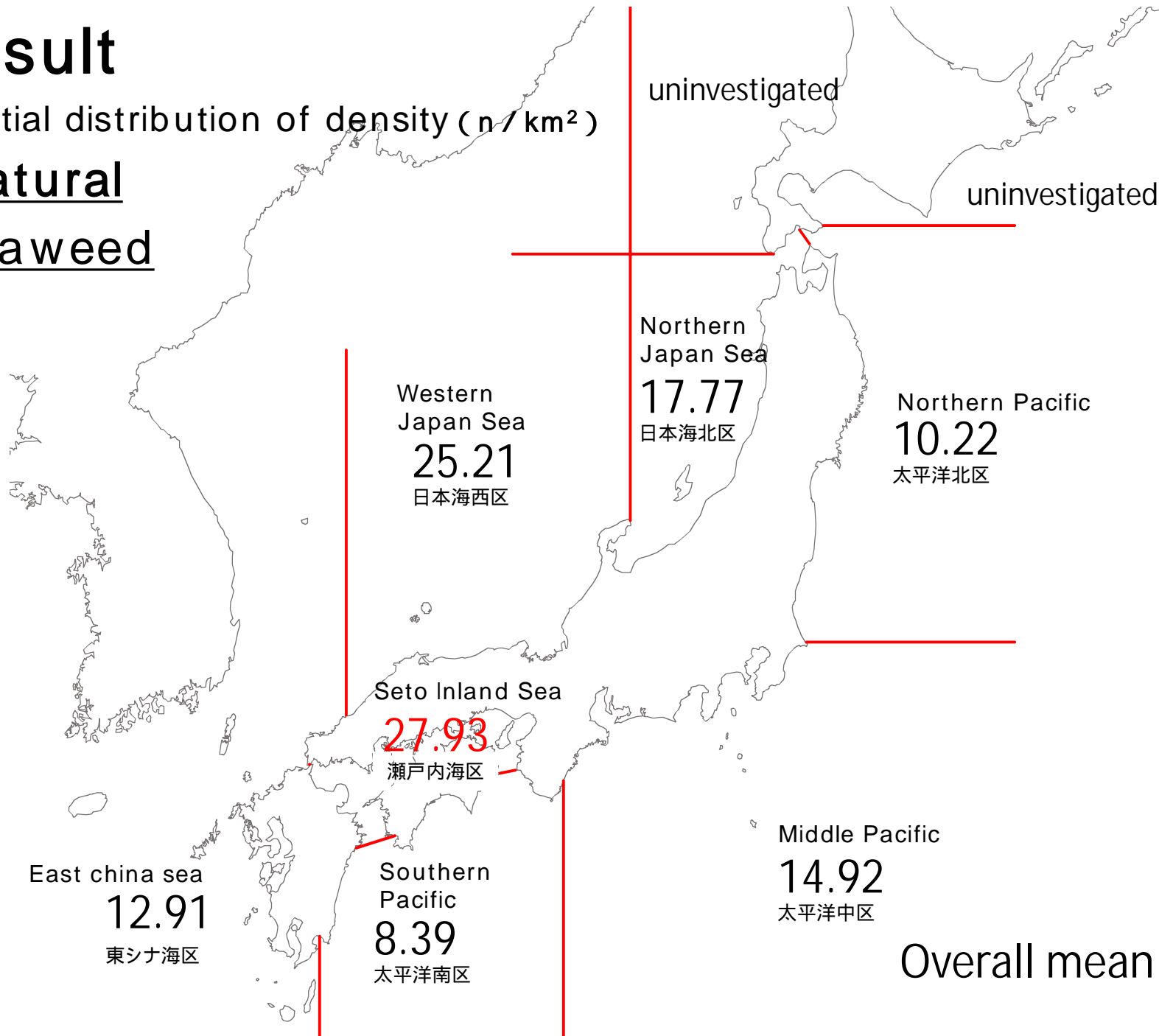
Other article



Result

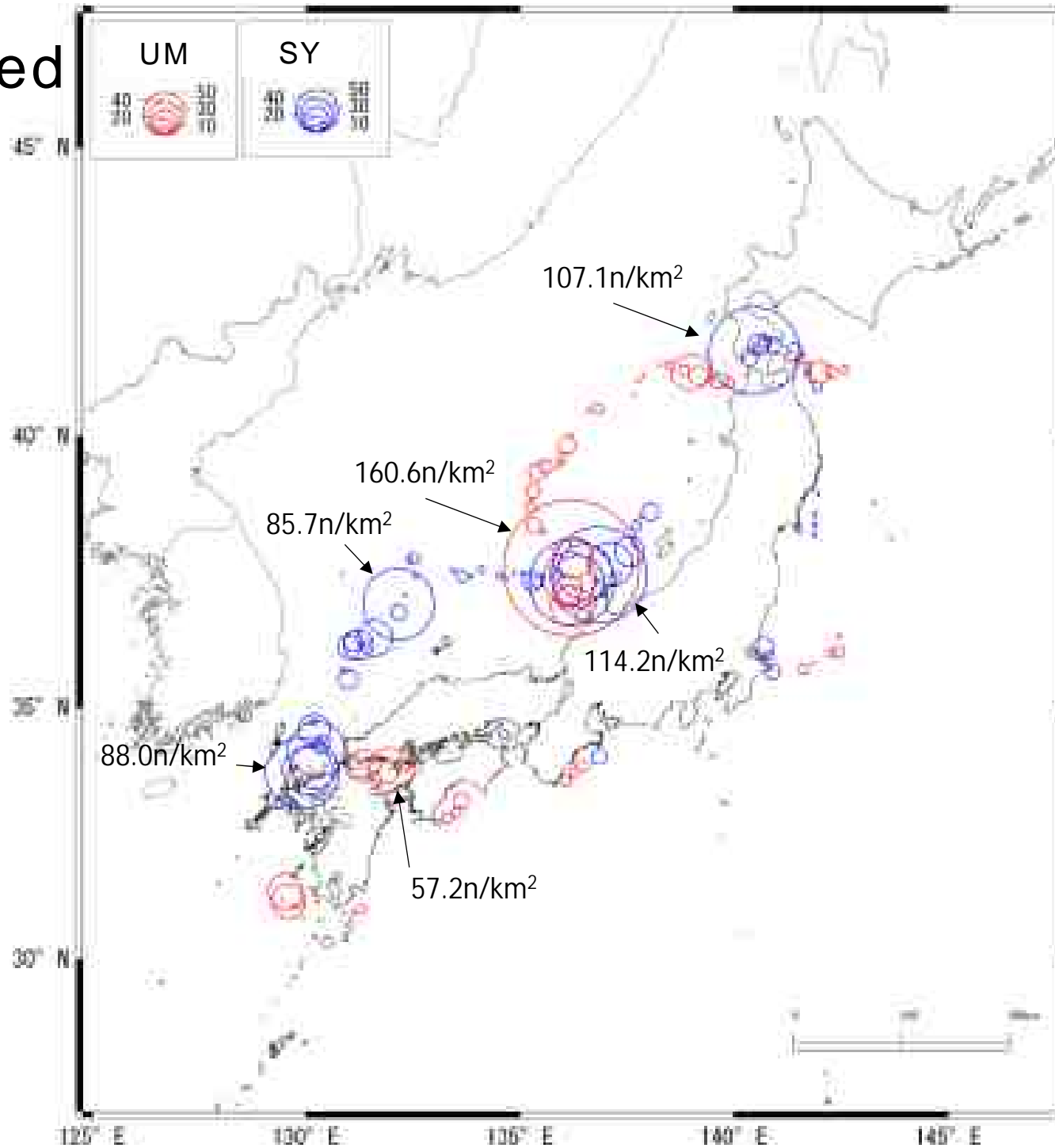
Spatial distribution of density (n / km^2)

Natural seaweed



Overall mean 17.11

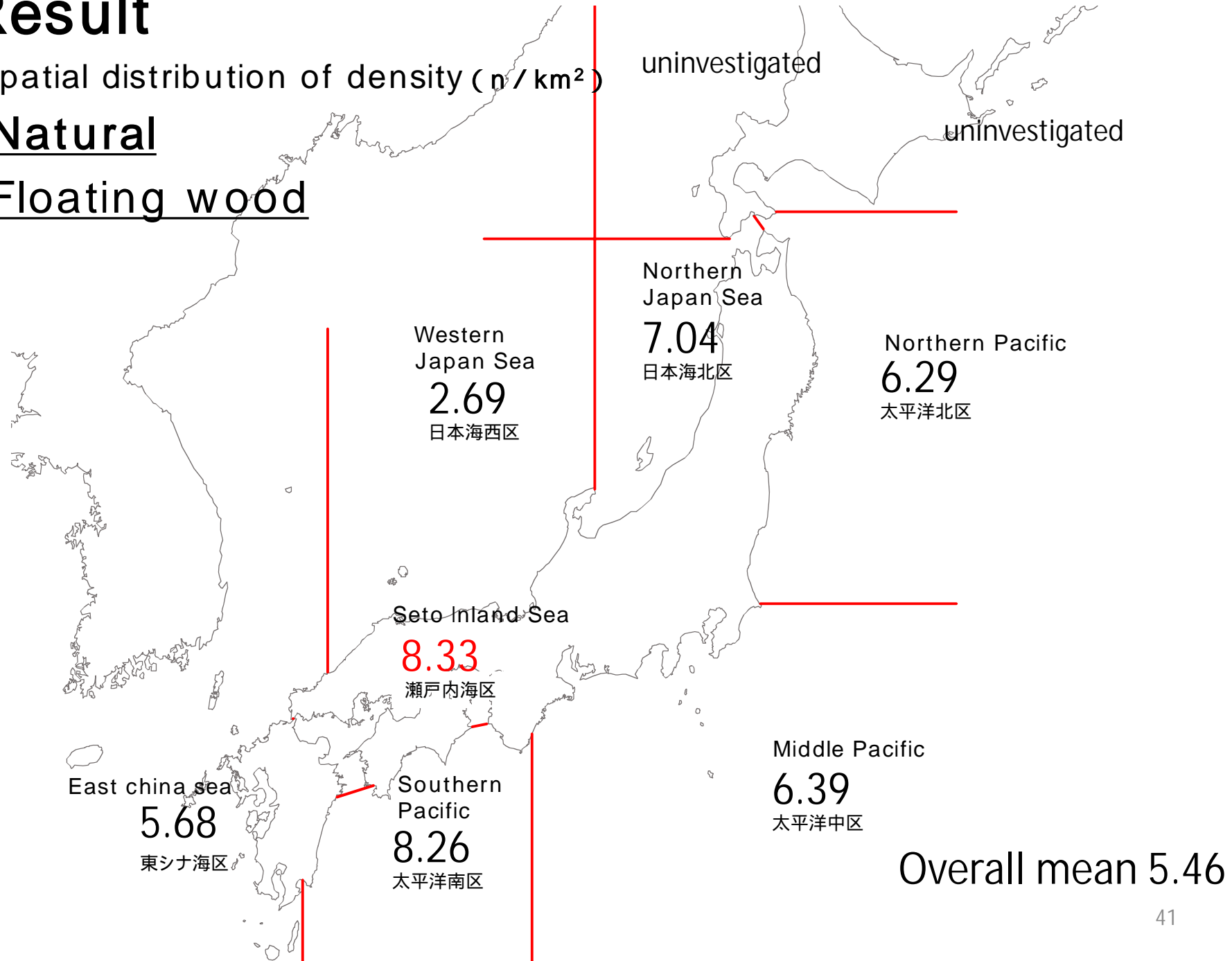
Seaweed



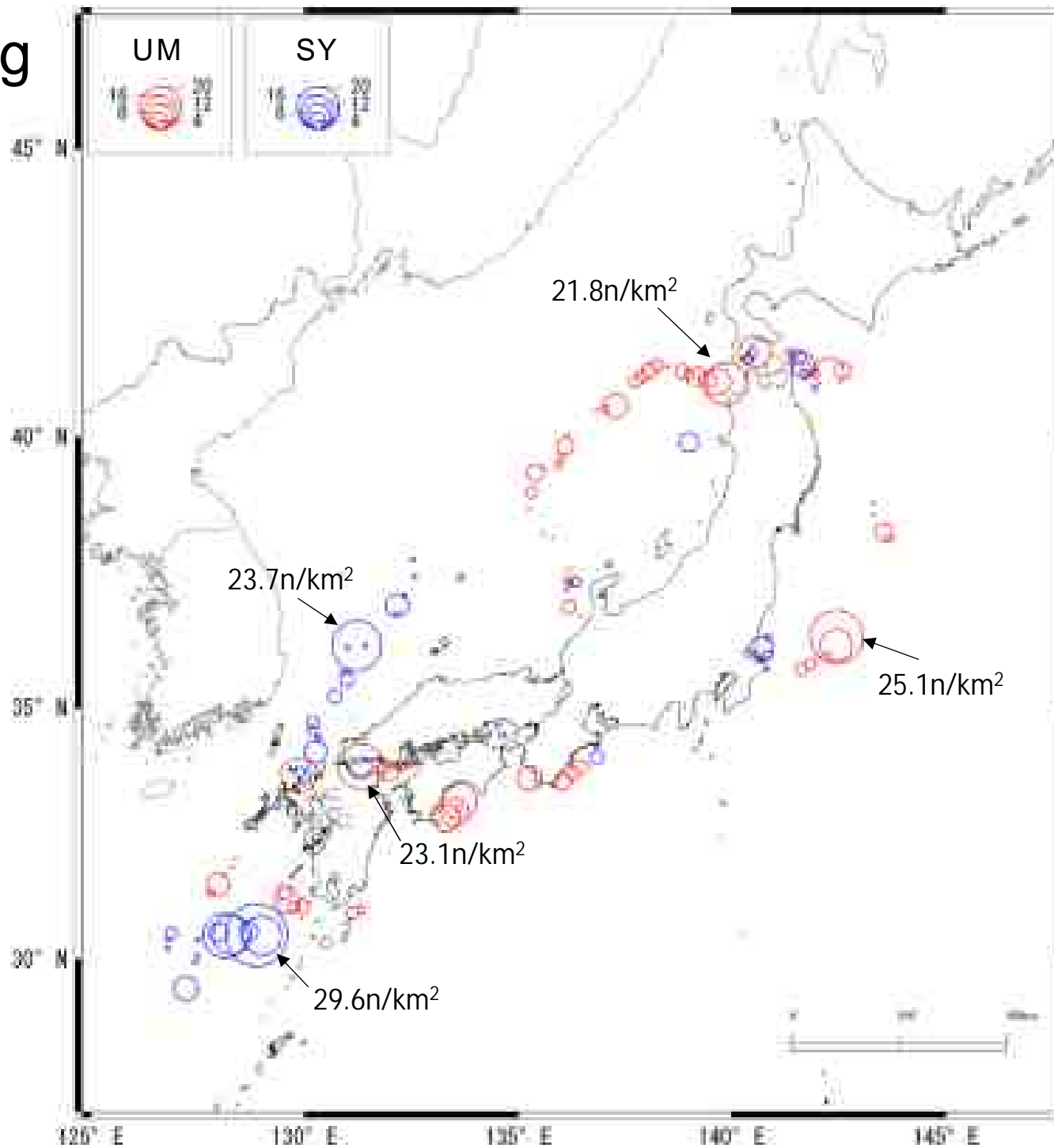
Result

Spatial distribution of density (n / km^2)

Natural Floating wood



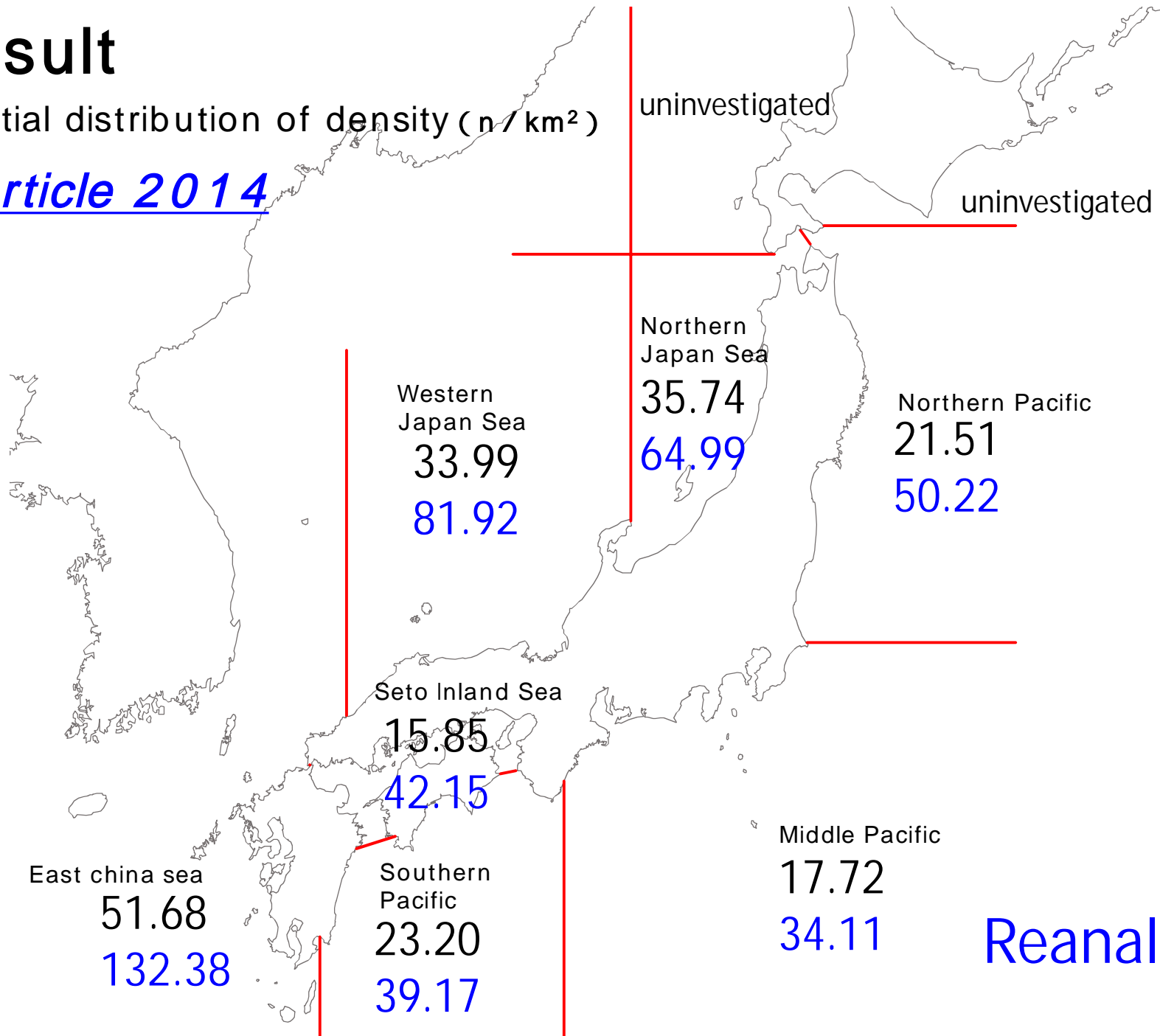
Floating wood



Result

Spatial distribution of density (n / km^2)

Article 2014



Reanalysis

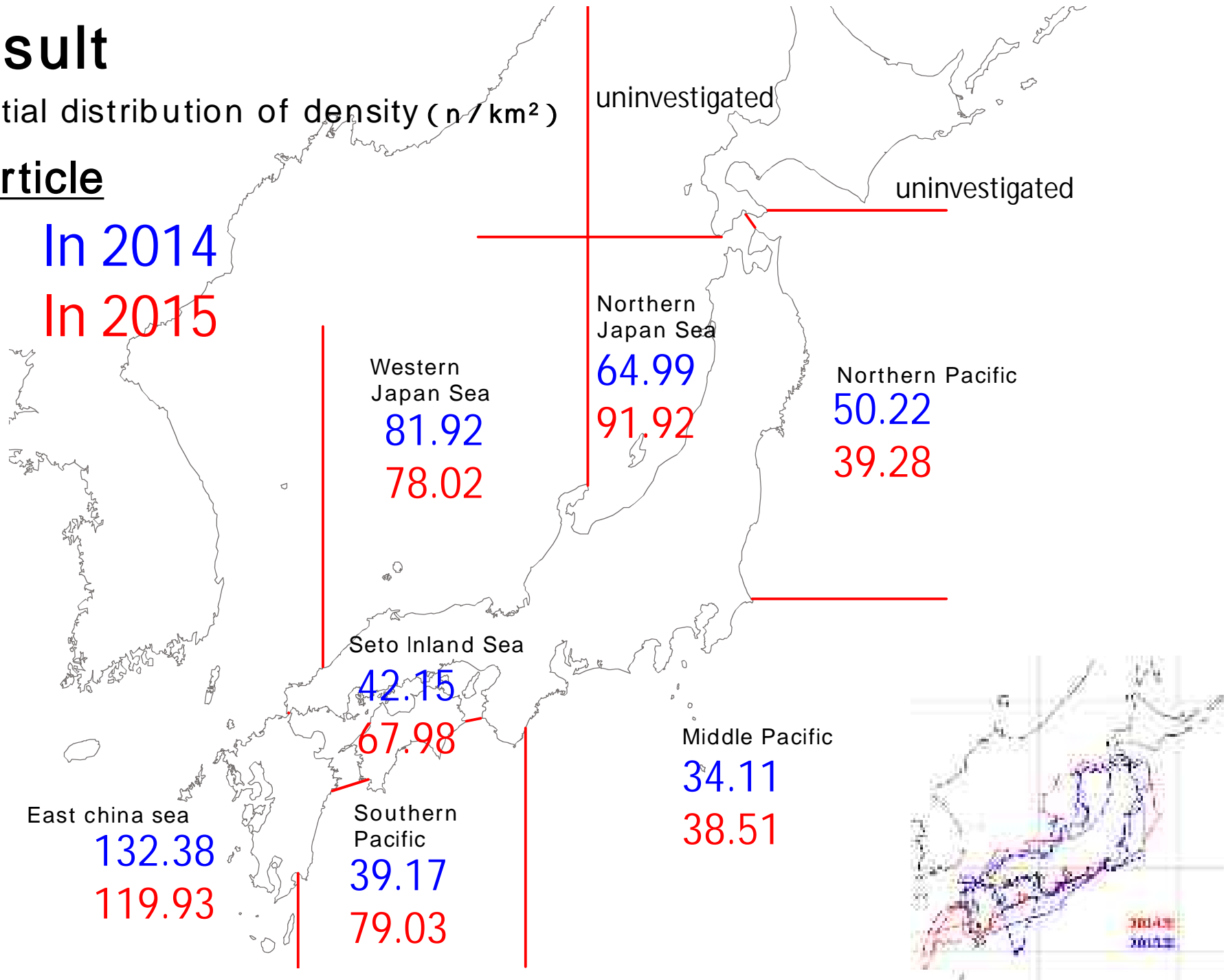
Result

Spatial distribution of density (n / km^2)

Article

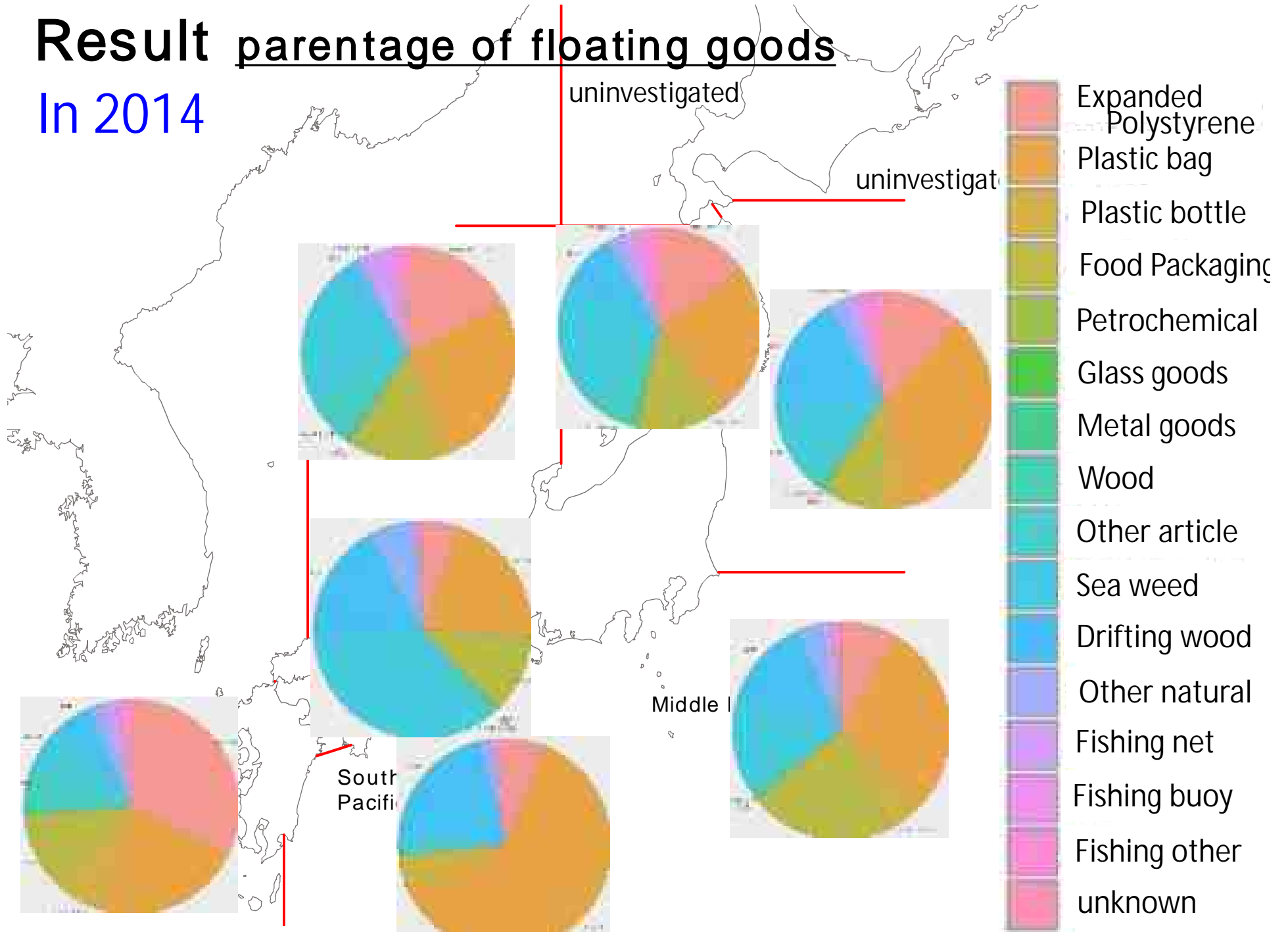
In 2014

In 2015



Result parentage of floating goods

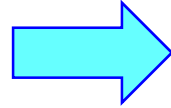
In 2014



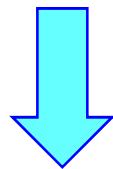
Where will they go?



Break?



Micro prastics?



To bottom?



Sea floor debris?



Beach?

Sea floor debris

From East China Sea



Fishing gear

Can.

Sea floor debris

Water off Ibaragi pref.



Foot mat



Sheet



clothes



Packing band



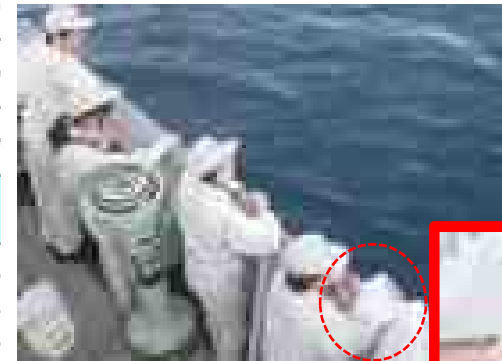
Glass bottle

Printed Japanese
Can

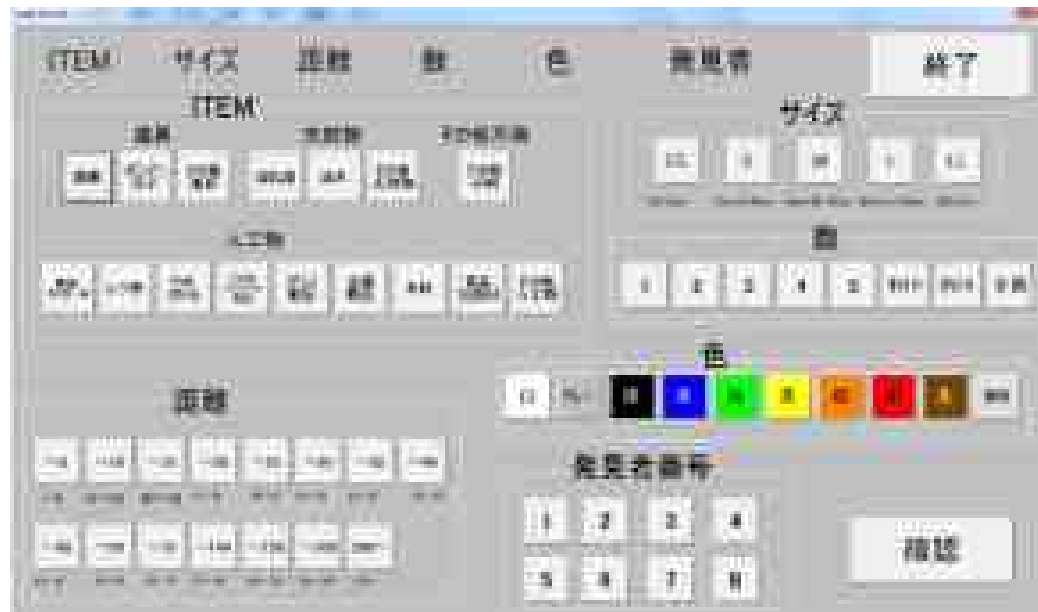
2013.08
2015.07
2014.01

2014

調査物 目録調査管理				調査番号: 1			
日付	月	日	開始時刻	:	終了時刻	:	天候
記録者			開始位置		終了位置		調査の種類
記録場所 左舷/右舷			緯度: - -	経度: - -	深度		風況
コース・速度 /			深度: - -	経度: - -	水深		波高
種類および材質など	色	図	サイズ	撮影日時	発見時刻	発見者	備考
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			
漁獲 海水産物 プラチ	茶	白	68.5.11.11	1:1			



2015



Conclusion

- Japan sea area was more density than Pacific area for article items. Especially, high density spot distributed in east china sea and around Tsushima.
- A certain amount of floating expanded polystyrene was observed in the East China Sea and Tsushima Strait.
- High-density area of plastic sheet and bag existed near the coast like off Fukuoka pref. and off Noto Peninsula. (derived from land?)
- Many marine debris still hide in a covert place.