

# Jellyfish fisheries of the world – past, present, and future

6<sup>th</sup> International Zooplankton Production Symposium – 10 May 2016

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University of British Columbia, Vancouver, Canada



W I N G

茶 華

H O N G K O N G  
W A H

# 即食 調味海蜇絲



香

辣

味

Seasoned Sliced Jellyfish (Chili Flavour)





· 麻辣味 ·  
Sesame Chilli Flavour



FENG ZHENG  
丰 正

即食

INSTANT  
NATURAL JELLYFISH

天然海蜇



净含量 海蜇+配料: 150克 (5.2oz)  
NET WT 海蜇: 142克 (5.0oz)  
天然食品有色差、斑点现象, 敬请放心享用



# ANGUS BEEF CHART

**OTHER CUTS**

Beef for Stew	Cubed Steak
Beef for Kabobs	Ground Beef

**RIB**

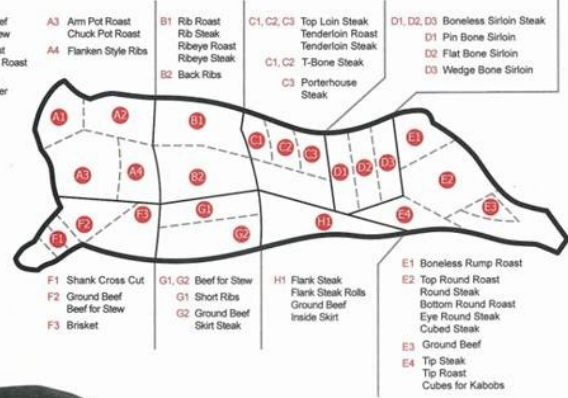
Rib Roast, Large End	Rib Roast, Small End	Rib Steak, Small End
Ribeye Roast Business	Ribeye Steak Business	Back Ribs

**LOIN**

Top Loin Steak Business	T-Bone Steak	Porterhouse Steak
Tenderloin Roast (Filet Mignon)	Tenderloin Steak (Filet Mignon)	

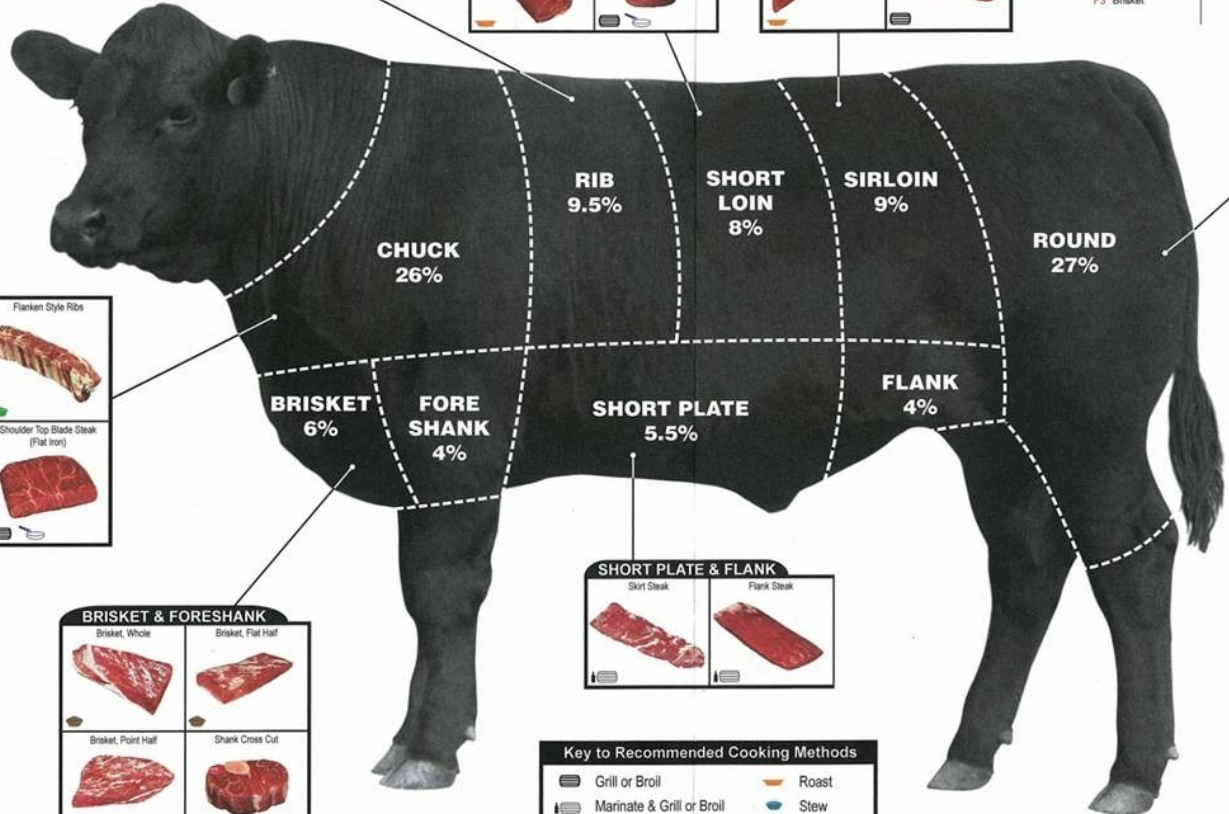
**SIRLOIN**

Sirloin Steak, Flat Bone	Sirloin Steak, Round Bone	Top Sirloin Steak Business
Tri-Tip Roast	Tri-Tip Steak	



**CHUCK**

7-Bone Pot Roast	Arm Pot Roast	Blade Roast
Under Blade Pot Roast	Chuck Pot Roast	Chuck Eye Roast
Mock Tender Roast	Chuck Top Blade Steak	Shoulder Petite Tender
Shoulder Petite Tender	Shoulder Petite Tender Medallions	



**ROUND**

Round Steak Business	Bottom Round Roast	Bottom Round Steak
Eye Round Roast	Eye Round Steak	Top Round Steak
Boneless Rump Roast	Tip Roast, Cap Off	Tip Steak

**BRISKET & FORESHANK**

Brisket, Whole	Brisket, Flat Half
Brisket, Point Half	Shank Cross Cut

**SHORT PLATE & FLANK**

Skirt Steak	Flank Steak
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**Key to Recommended Cooking Methods**

Grill or Broil	Roast
Marinate & Grill or Broil	Stew
Skillet	Braise
Stir-Fry	Pot Roast

A 1200 pound, Yield Grade 1 steer yields 518 pounds of retail cuts from a 750 pound carcass.

A 1200 pound, Yield Grade 2 steer yields 502 pounds of retail cuts from a 750 pound carcass.

A 1200 pound, Yield Grade 3 steer yields 435 pounds of retail cuts from a 750 pound carcass.

**Of the retail cuts, on a carcass weight basis:**  
 31% are steaks  
 31% are roasts  
 38% is ground beef and stew meat

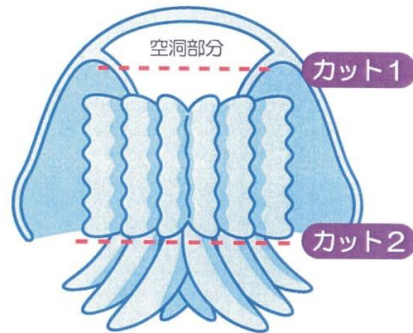
**American Angus Association**  
 3201 Frederick Ave., St. Joseph, MO 64506  
 (816) 383-5100 • www.angus.org

Meat cut photos and key to recommended cooking methods courtesy of The Beef Checkoff. 01/07

# キャノンボール さしみくらげの切り分け方



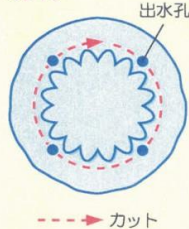
- ①袋から取り出し、水気をよく切って下さい。
- ②次に傘・ネック・足と部位ごとにカットします。(下図参照)



## カット1

くらげを逆さまにし、傘を広げて下さい。  
(注1)この時、頭の内側に4つの穴(出水孔)がありますので、穴を結ぶ要領で円を描きながらカットして、傘とネックを切り離して下さい。

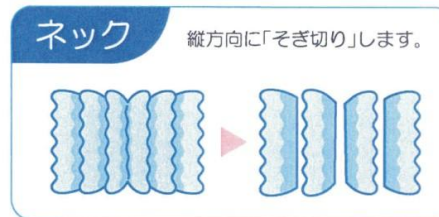
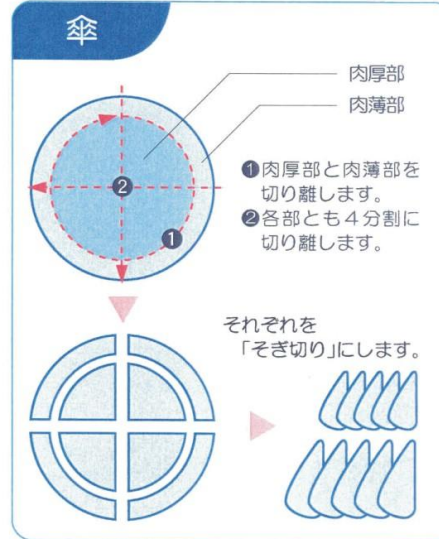
(注1)



## カット2

ネックと足を切り離します。

- ③最後に部位ごとに「そぎ切り」し、血に盛りつけて出来上がり。(下図参照)





# Zhang Hua (232 – 300 A.D.) | Jin Dynasty





# APICII COELII

DE  
OPSONIIS  
ET  
CONDIMENTIS,

Sive  
ARTE COQUINARIA,

LIBRI DECEM.

Cum Annotationibus  
MARTINI LISTER,

è Medicis domesticis Serenissimæ Majestatis Reginae Annae,

ET

Notis selectioribus, variisque lectionibus integris,  
HUMELBERGII, BARTHII, REINESII,  
A. VAN DER LINDEN, & ALIORUM,  
ut & *Variarum Lectionum* Libello.

EDITIO SECUNDA,

*Longe auctior atque emendatior.*



AMSTELODAMI,  
Apud JANSSONIO-WAESBERGIOS.

MDCCIX.

**[4.2.12] patina de abua sine abua: pulpas piscis assi uel elixi minutatim facies ita abundanter ut patinam qualem uoles implere possit. teres piper et modicum rute, suffundes liquamen quod satis erit et olei modicum et conmisces in patina cum pulpis sic et oua cruda confracta, ut unum corpus fiat. desuper leuiter conpones urticas marinas ut non cum ouis misceantur. inpones ad uaporem ut cum ouis ire non possint et cum siccauerint super aspargis piper tritum et inferes. ad mensam nemo agnoscet quid manducet.**

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**STINGERS**







# Attack of the jellyfish: Sea creatures shut down ANOTHER power station amid claims population surge is due to climate change

By DAILY MAIL REPORTER

Last updated at 8:10 AM on 6th July 2011

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Another power station was shut down by jellyfish today amid claims that climate change is causing a population surge among the species.

A huge swarm clogged up the Orot Rabin plant in Hadera, Israel, a day after the Torness nuclear facility in Scotland was closed in a similar incident.

Hadera ran into trouble when jellyfish blocked its seawater supply, which it uses for cooling purposes, forcing officials to use diggers to remove them.



© AFP/Getty Images

Nuisance: A digger drops jellyfish cleared from the power station in Hadera, Israel

## Jellyfish attack destroys salmon

**A jellyfish invasion has wiped out Northern Ireland's only salmon farm, killing more than 100,000 fish.**

A Northern Salmon spokesman said last week's attack could cost more than £1m.

Billions of small jellyfish, known as Mauve Stingers, flooded into the cages about a mile into the Irish Sea, off Glenarm Bay and Cushendun.

The jellyfish covered an area of up to 10 square miles and a depth of 35 feet. Rescuers tried to reach the cages but the density of fish made it impossible.

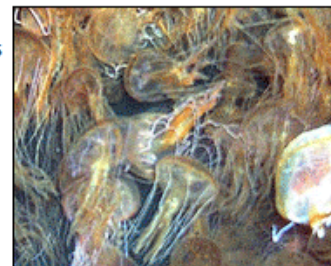
Managing director John Russell said he had never seen anything like this in 30 years in the business.

"The sea was red with these jellyfish and there was nothing we could do about it, absolutely nothing," he said.

"It's a disaster for this company - you cannot legislate for something like this."

He says the firm could take at least two years to recover.

The company has some high-profile clients, with Irish chef Richard Corrigan serving Glenarm salmon to the Queen on her 80th birthday last year as part of the BBC's Great British Menu programme.



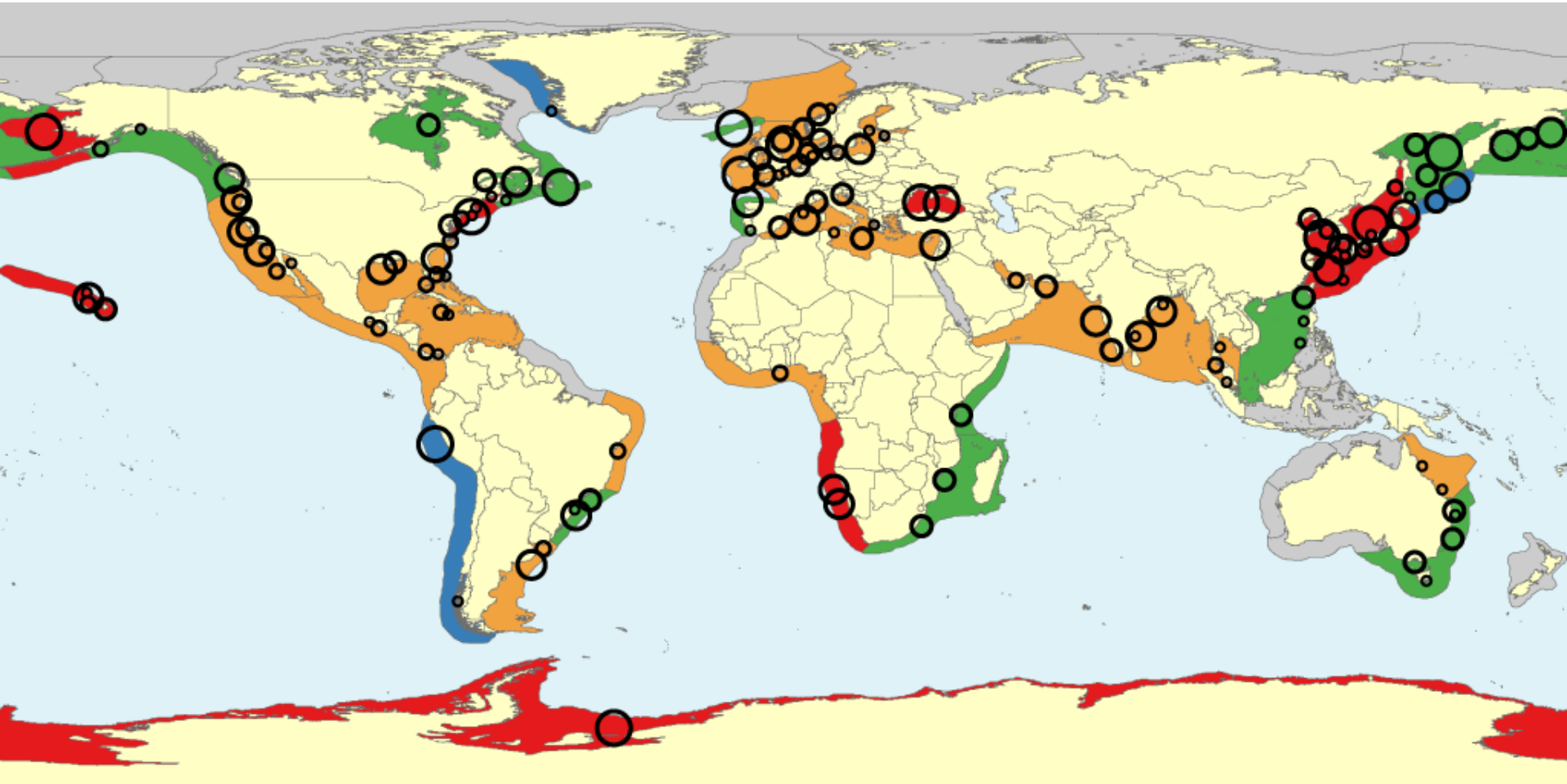
The density of jellyfish stopped workers from reaching cages

OPEN Enlarge Image



■ Increase (high certainty) – 10 (22%)  
■ Increase (low certainty) – 18 (40%)

■ Stable/Variable – 14 (31%)  
■ Decrease – 3 (7%)



ICES Journal of Marine Science (2016), 73(4), 1012–1018. doi:10.1093/icesjms/fsv255

## Food for Thought

# We should not assume that fishing jellyfish will solve our jellyfish problem

M. J. Gibbons<sup>1\*</sup>, F. Boero<sup>2,3</sup>, and L. Brotz<sup>4</sup>

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<sup>2</sup>*DiSTeBA, Università del Salento, Lecce 73100, Italy*

<sup>3</sup>*CNR-ISMAR, Italy*

<sup>4</sup>*Sea Around Us, Institute for the Oceans and Fisheries, University of British Columbia, 2202 Main Mall, Vancouver, BC, Canada V6T 1Z4*

\*Corresponding author: tel: + 27 21 959 2475; fax: + 27 21 959 2312; e-mail: [mgibbons@uwc.ac.za](mailto:mgibbons@uwc.ac.za)

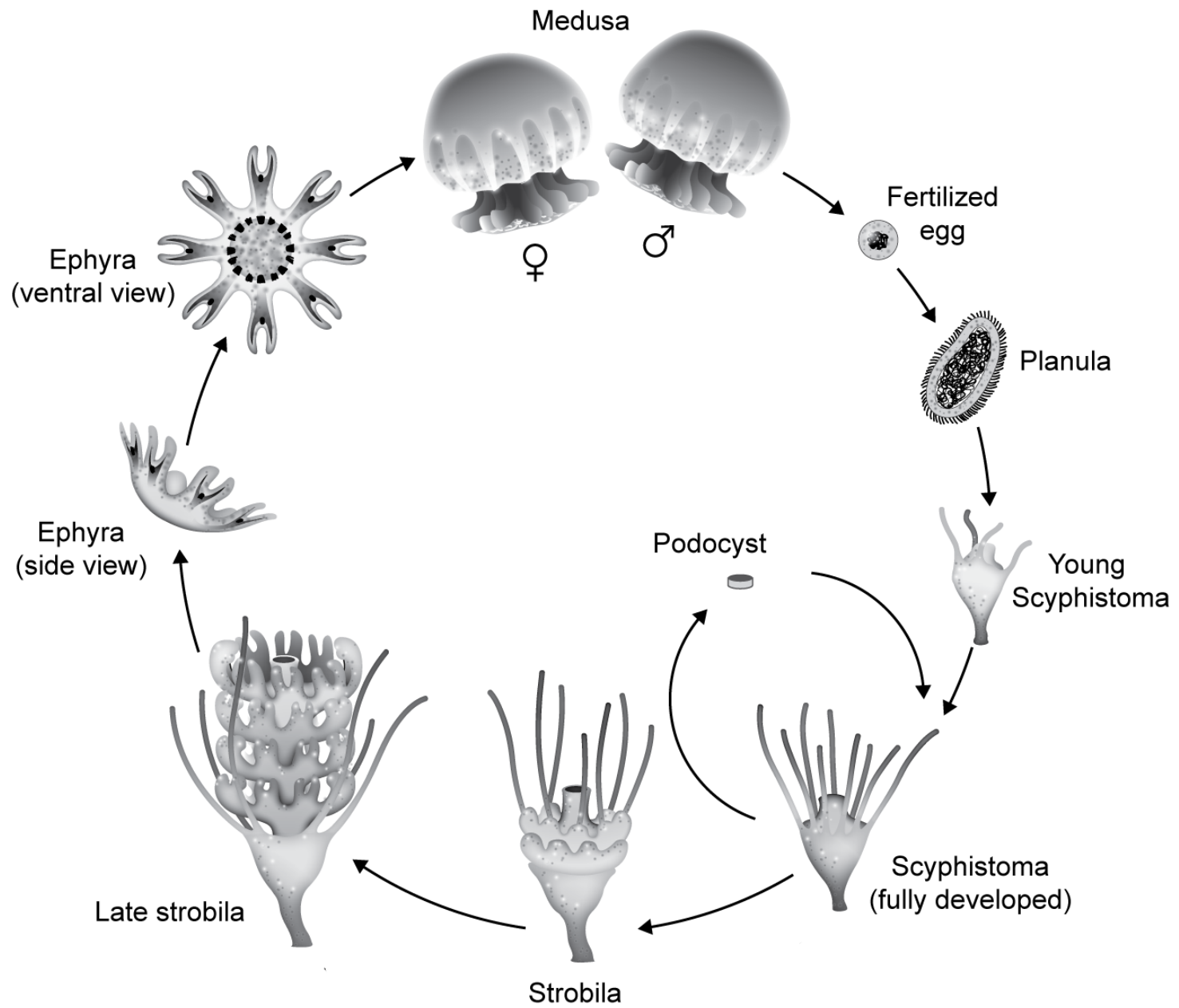
Gibbons, M. J., Boero, F., and Brotz, L. We should not assume that fishing jellyfish will solve our jellyfish problem. – ICES Journal of Marine Science, 73: 1012 – 1018.

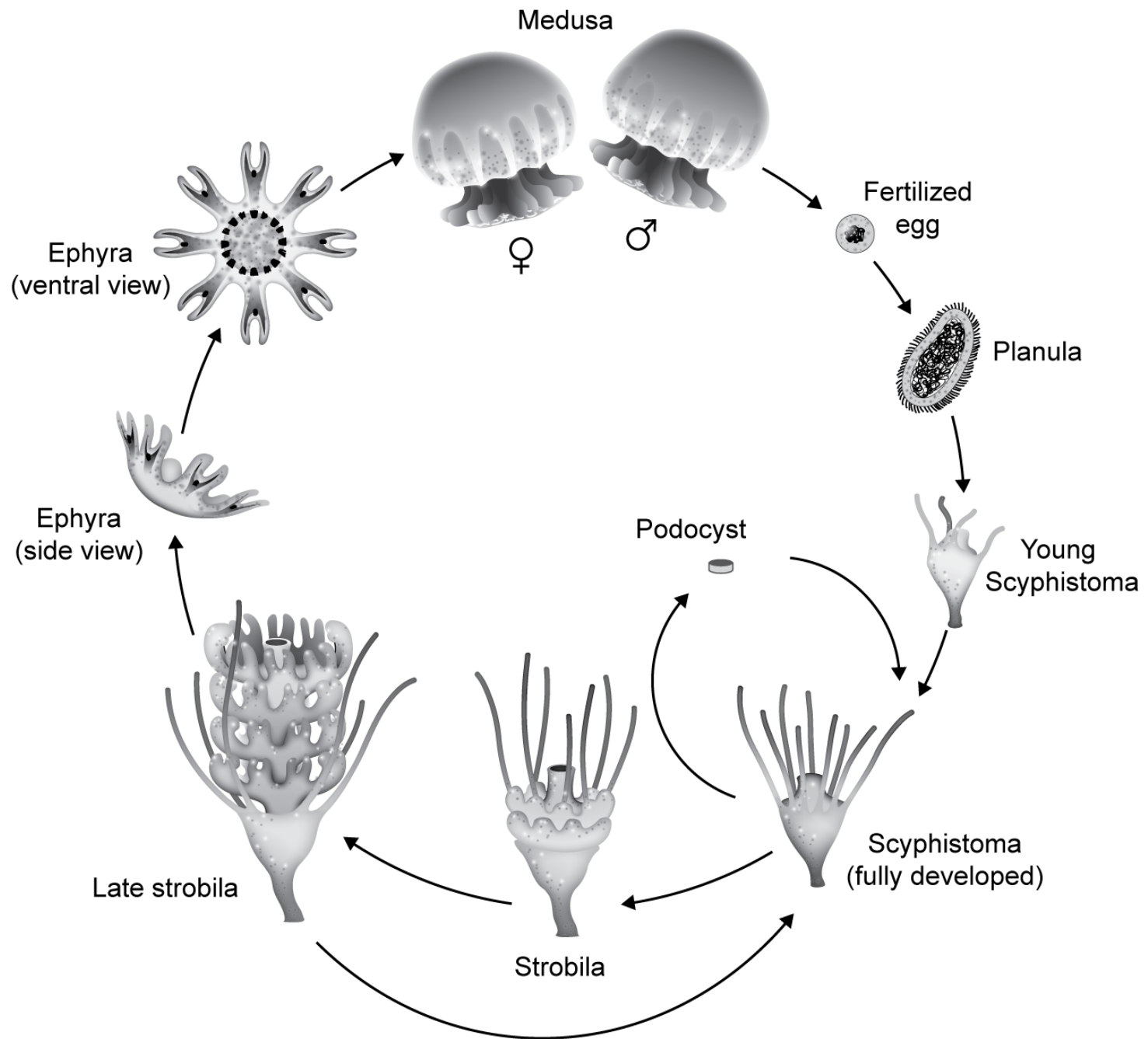
Received 28 September 2015; revised 27 November 2015; accepted 1 December 2015; advance access publication 24 December 2015.

Whether jellyfish are increasing or not in the global ocean is a subject of some debate, but the fact remains that when they bloom, jellyfish can negatively affect local economies. Despite this, there has been no robust debate about the idea of deliberately removing jellyfish as a means of population control. Here, we discuss the effects of fishing for jellyfish, either as a sustainable resource and/or as a way to simply reduce their nuisance value, on both individual jellyfish populations and the ecosystem. Given that the drivers influencing each local bloom are different, or that the effects of more widespread drivers may be manifested differently at each locale, our priority at population control/use needs to be more basic research on jellyfish. While we do not advocate a no-fishing approach, we emphasize the need to be cautious in embracing jellyfish fisheries as a panacea and we need to consider the management of each bloom on a case-by-case basis.

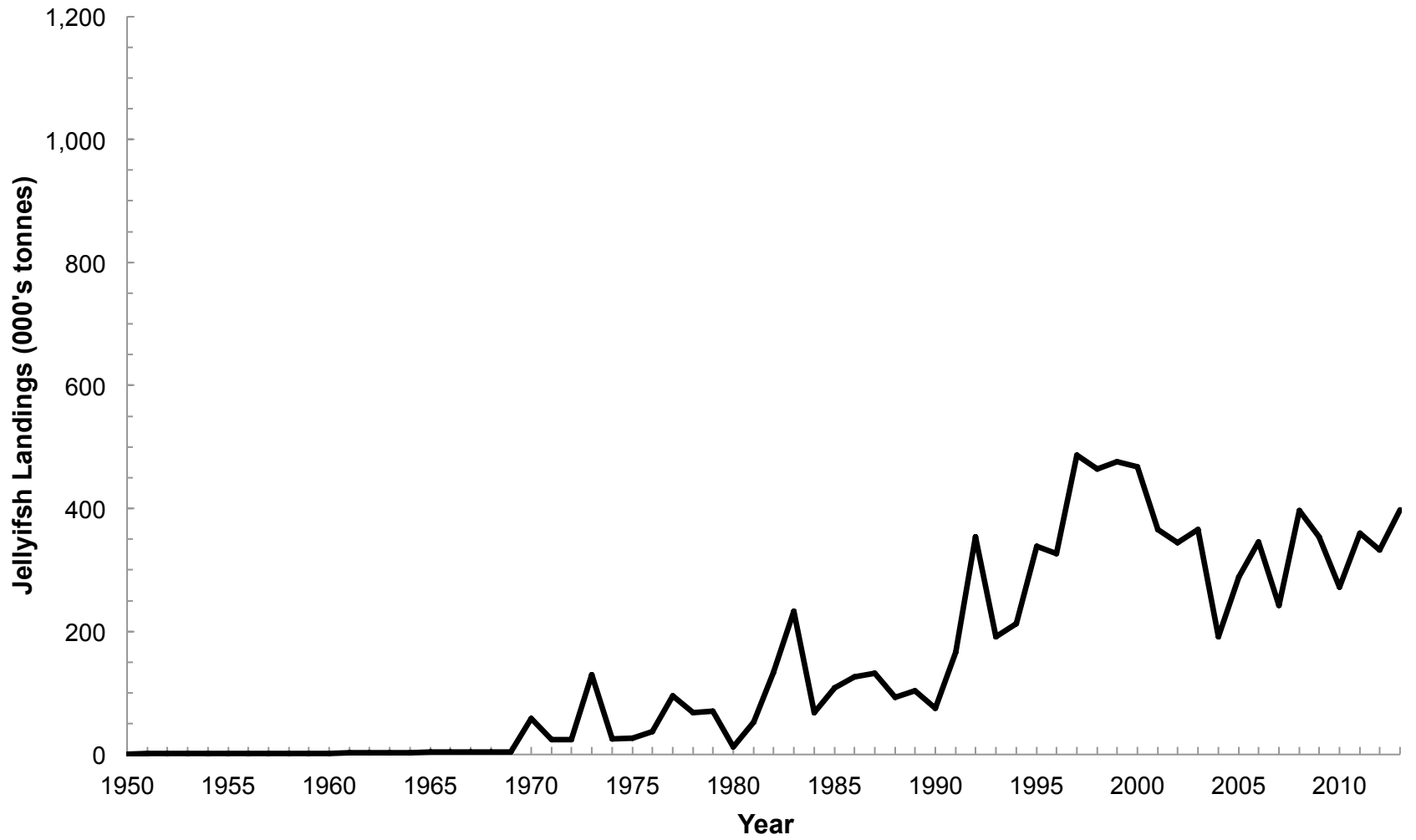
# Some concerns about fishing for jellyfish

- Only some species are 'edible'
- Alum used in processing (health & pollution)
- Minimal research (ecological effects?)
- Minimal management (possible conflict)
- Desire for sustainable fisheries (hatcheries)











# Catch Reconstruction

1. Identification and validation of existing reported catch time series (*e.g.*, FAO statistics);
2. Identification of countries and time periods not covered by (1), *i.e.*, missing catch data, via literature searches and consultations;
3. Search for available alternative information sources to supply the missing catch data in (2), through extensive literature searches and consultations with local experts;
4. Development of data anchor points in time for missing data items;
5. Interpolation for time periods between data anchor points for total catch;
6. Estimation of final total catch time series estimates for total catch, combining reported catches (1) and interpolated missing data series (5).

*Rhopilema esculentum*

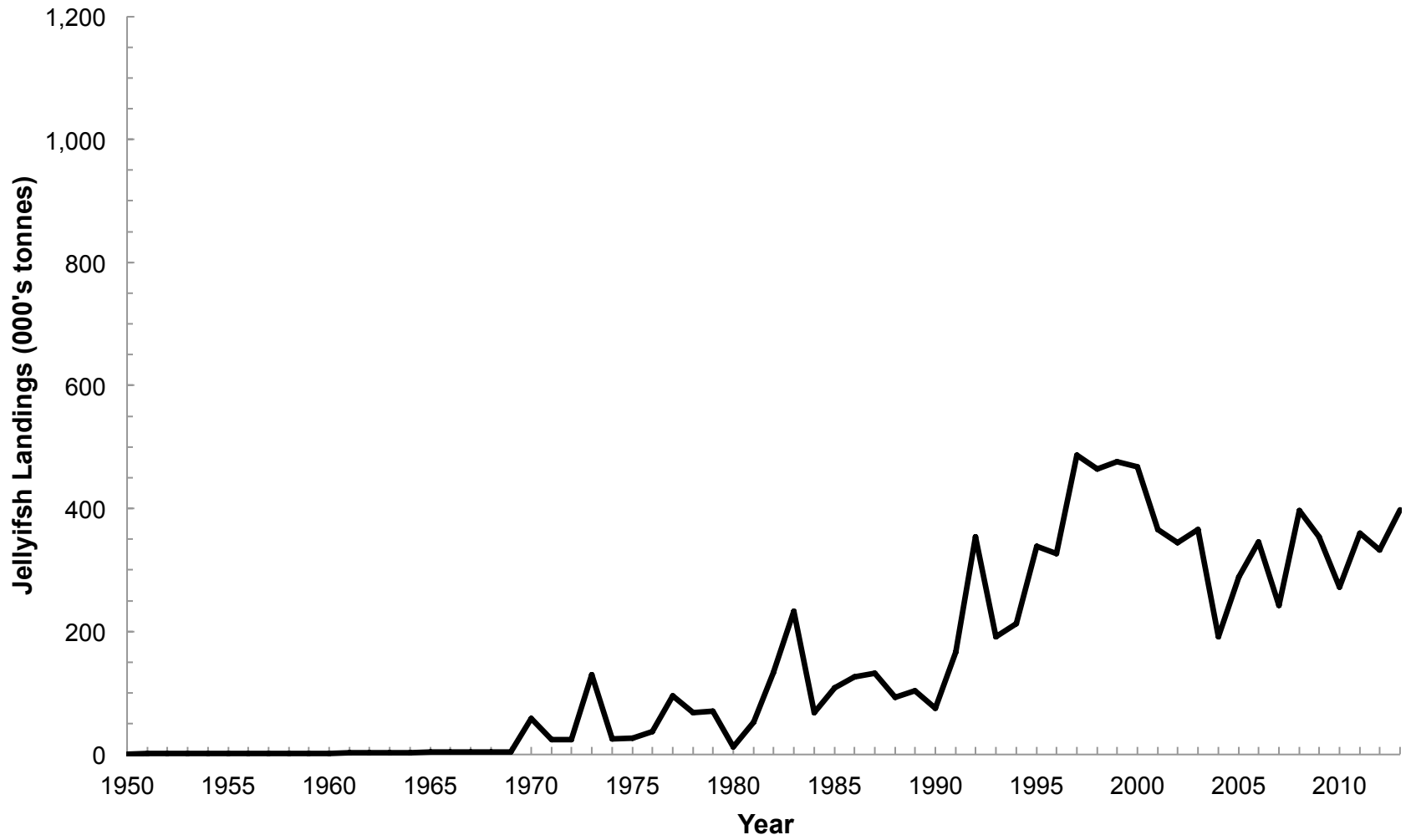


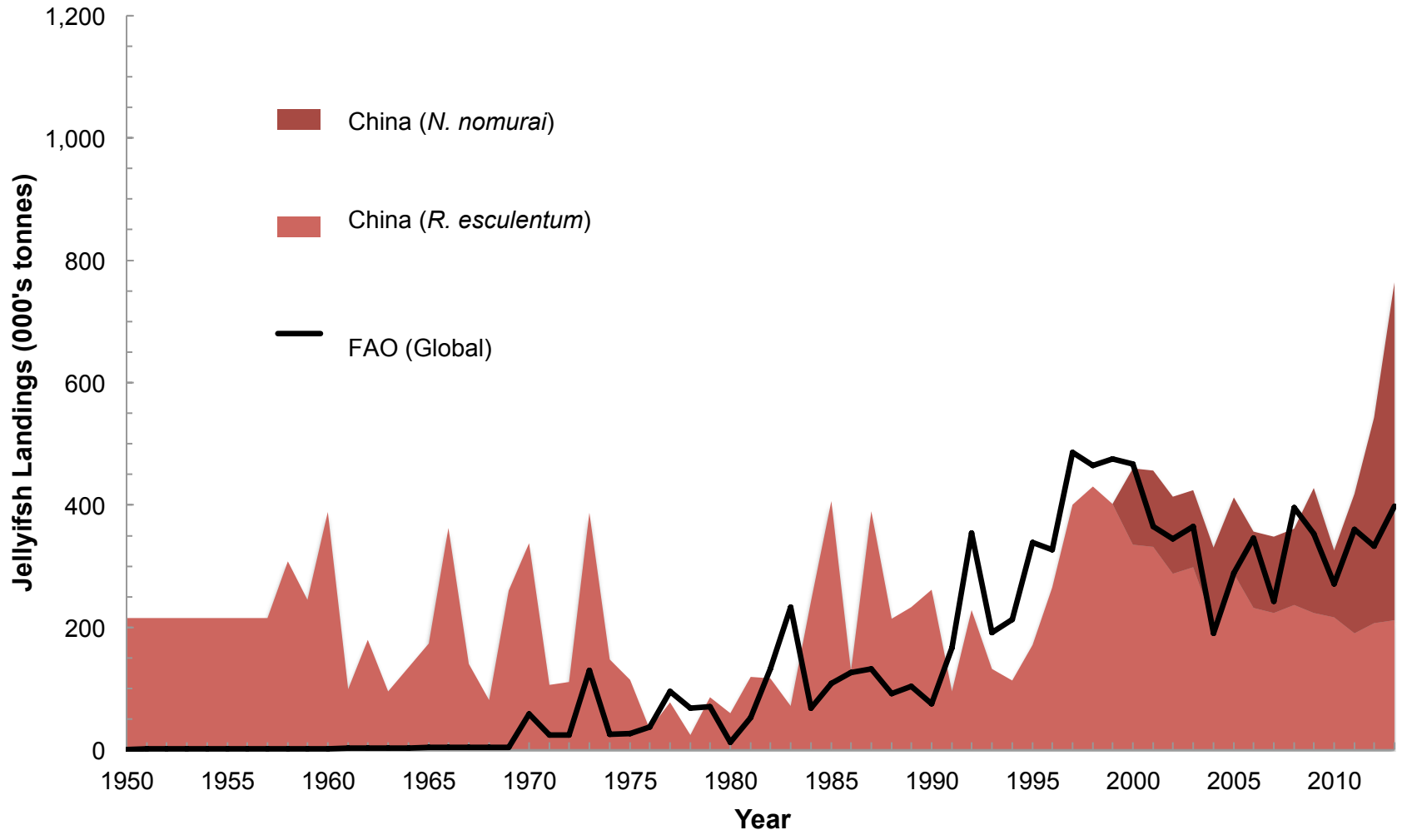
*Rhopilema esculentum*



*Nemopilema nomurai*







# Countries currently fishing jellyfish

China

Japan

Thailand

Myanmar

India

Iran

Vietnam

Sri Lanka

Indonesia

Pakistan

Mexico

Russian Federation

Bahrain

Philippines

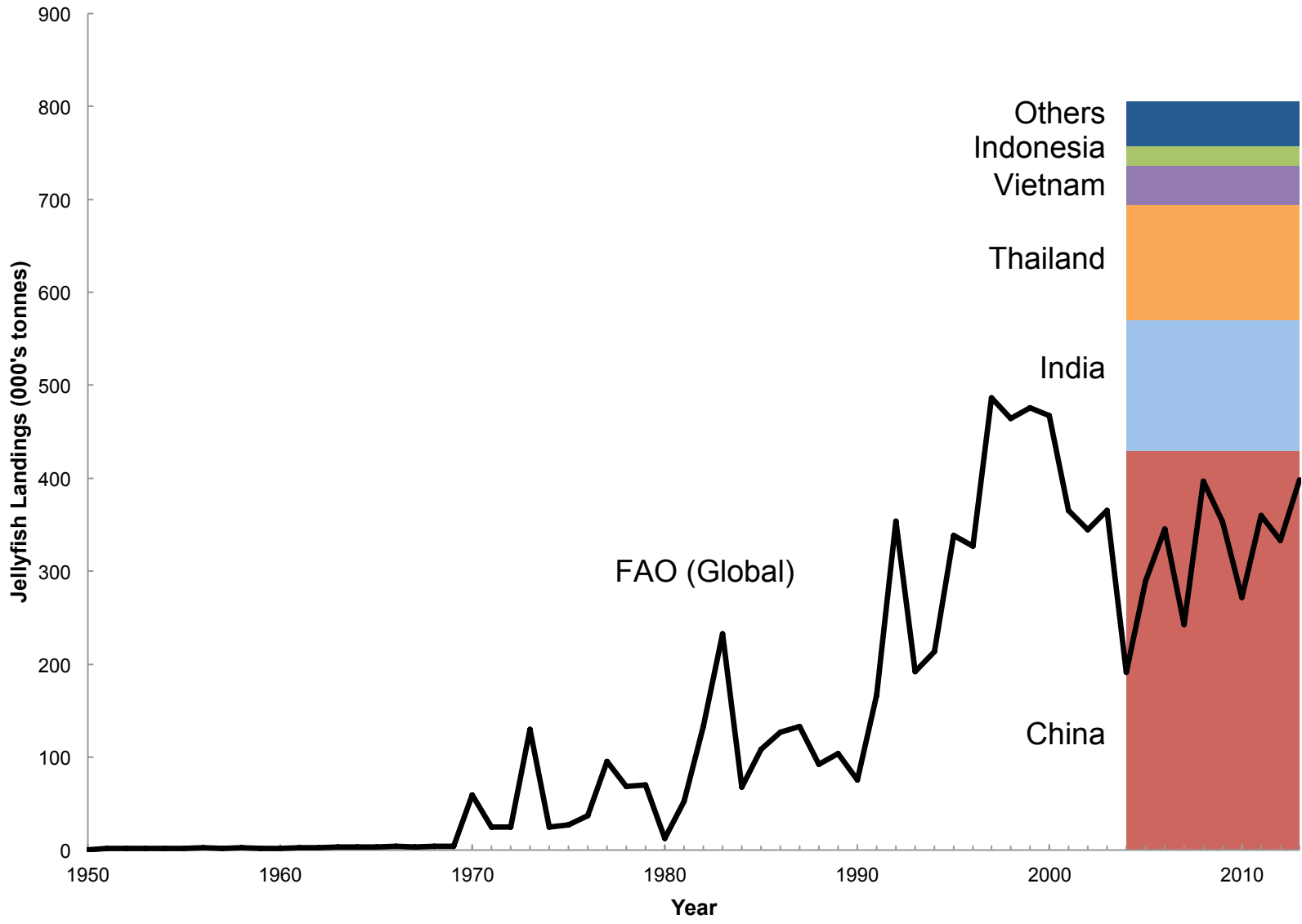
Malaysia

Korea (South)

U.S.A.

Australia







*Cao et al. 2015, Science*



# Target Species

Family	Species
Cassiopeidae	<i>Cassiopea ndrosia</i>
Catostylidae	<i>Acromitus hardenberqi</i>
	<i>Catostylus mosaicus</i>
	<i>Catosylus perezii</i>
	<i>Crambione mastigophora</i>
	<i>Crambionella annandalei</i>
	<i>Crambionella orsini</i>
	<i>Crambionella helmbiru</i>
	<i>Crambionella stuhlmanni</i>
Cepheidae	<i>Cephea cephea</i>
	<i>Cotylorhiza tuberculata</i>
Lobonematidae	<i>Lobonema smithi</i>
	<i>Lobonemoides gracilis</i>
	<i>Lobonemoides robustus</i>
Lychnorhizidae	<i>Lychnorhiza lucerna</i>
Mastigiidae	<i>Mastigias</i> sp.
	<i>Phyllorhiza punctata</i>
Rhizostomatidae	<i>Rhizostoma octopus</i>
	<i>Rhizostoma pulmo</i>
	<i>Rhizostoma</i> sp.
	<i>Rhopilema esculentum</i>
	<i>Rhopilema hispidum</i>
	<i>Rhopilema nomadica</i>
	<i>Rhopilema verrilli</i>
Rhizostomatidae?	(suspected unique sp.)
Stomolophidae	<i>Nemopilema nomurai</i>
	<i>Stomolophus meleagris</i>

# Target Species

Family	Species
Cassiopeidae	<i>Cassiopea ndrosia</i>
Catostylidae	<i>Acromitus hardenberqi</i>
	<i>Catostylus mosaicus</i>
	<i>Catosylus perezii</i>
	<i>Crambione mastigophora</i>
	<i>Crambionella annandalei</i>
	<i>Crambionella orsini</i>
	<i>Crambionella helmbiru</i>
	<i>Crambionella stuhlmanni</i>
Cepheidae	<i>Cephea cephea</i>
	<i>Cotylorhiza tuberculata</i>
Lobonematidae	<i>Lobonema smithi</i>
	<i>Lobonemoides gracilis</i>
	<i>Lobonemoides robustus</i>
Lychnorhizidae	<i>Lychnorhiza lucerna</i>
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	<i>Phyllorhiza punctata</i>
Rhizostomatidae	<i>Rhizostoma octopus</i>
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	<i>Rhizostoma</i> sp.
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Rhizostomatidae?	(suspected unique sp.)
Stomolophidae	<i>Nemopilema nomurai</i>
	<i>Stomolophus meleagris</i>

Class	Order	Family	Species
Cubozoa	Carybdeida	Carybdeidae	<i>Carybdea rastoni</i>
			<i>Chiropsalmus</i> sp.
			<i>Tamoya</i> sp.
Scyphozoa	Coronatae	Periphyllidae	<i>Periphylla periphylla</i>
	Semaestomeae	Cyaneidae	<i>Cyanea nozakii</i>
		Pelagiidae	<i>Chrysaora pacifica</i>
			<i>Chrysaora plocamia</i>
			<i>Pelagia noctiluca</i>
		Ulmaridae	<i>Aurelia aurita</i>
			<i>Aurelia labiata</i>
			<i>Aurelia</i> sp.

